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TICK TYPHUS IN NORTH QUEENSLAND.

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ENDEMIC TYPHUS was first recognized in Australia by Hone,[1] of Adelaide, who in 1921 observed a series of 16 cases. Later the disease in that State was shown to be murine typhus. Cases have since been reported from every State in the Commonwealth. Typhus occurs mainly as an urban disease and shows a predilection for people whose occupations bring them into association with rodents and their ectoparasites. The most violent outbreak is that which occurred at Toowoomba, Queensland, in 1925. Wheatland[2] gave an account of this epidemic, which affected about 200 people and was associated significantly with a rodent plague.

In 1935 scrub typhus (mite-borne typhus) was first reported in Australia by Langan and Mathew.[3] It has so far been found only in North Queensland, and this is probably related to the fact that its vector, *Trombicula deliensis*, has been found only in this part of Australia. Many service personnel have contracted the disease in the last two years on the Atherton Tableland. Scrub typhus does not differ here from the disease in New Guinea described in 1944 by Williams, Sinclair and Jackson.[4]

Our account is based on 12 patients suffering from tick typhus who were admitted to two Australian general hospitals on the Atherton Tableland in North Queensland between March, 1944, and February, 1945. Tick typhus has not previously been reported in Australia, although ticks have been suggested as possible vectors of Mossman fever (Breinl, Priestley and Fielding, 1914[5]) and of coastal fever (Heaslip, 1941[6])—ubiquitous fevers of North Queensland, the ætiology of which is still uncertain.

Tick-borne typhus has a world-wide distribution, occurring in the Americas as Rocky Mountain spotted fever, Eastern spotted fever, Brazilian spotted fever (synonym, Sao Paulo typhus), Colombian spotted fever and Bullis fever; in North Africa and Southern Europe as *fièvre boutonneuse*; in South Africa as South African tick bite fever and Kenya typhus; and in India as Indian tick typhus. No doubt this list is not yet complete. The antigenic relationships of these strains, transmitted by different species of the Ixodidæ family of ticks, have not yet been fully worked out. Until this has been done, it seems reasonable to give to the disease occurring in North Queensland a place-name in conformity with the usual practice. Accordingly we have named it "North Queensland tick typhus".

Epidemiology.

The Atherton Tableland, where these tick typhus infections were contracted and observed, lies some 30 miles inland from the east coast of North Queensland in a south-westerly direction from Cairns. The centre of the tableland lies approximately on latitude 17° south and longitude 145° east. Whereas the climate on the coast is tropical, that on the tableland is modified by virtue of its elevation to about 2,000 or 2,500 feet above sea level. For the greater part of the year the climate is temperate, though at times the humidity is high. There is an average rainfall of approximately 60 inches a year. Apart from small areas cleared for agriculture and dairy farming, the land is covered by light savannah country, interspersed with dense belts of rain forest. The latter consists of many species

of tall hardwoods interwoven by dense and impenetrable undergrowth. Locally it is known as rain forest or jungle, and is the type of country used in training troops for jungle warfare. It carries a dense marsupial and rodent fauna, and is infested with their ectoparasites—mites and ticks. Until this jungle country was occupied by the army in 1942, the only white people to traverse it were foresters and timber-getters. Since 1942 many thousands of troops have camped in the jungle and have been on extensive manœuvres through it. As the result of scrub typhus infections among the troops, small areas harbouring infected mites were defined and subsequently avoided.

Four man-biting species of ticks are known to occur here: *Ixodes holocyclus*, *Hæmophysalis bancrofti*, *Boophilus annulatus microplus*, and *Rhipicephalus sanguineus* (Roberts[7]). Of the four species, *Ixodes holocyclus* is the only one which has been found on tick-infested troops, and it is known to be the most androphilic. It is found most abundantly in the rain forests through which these men had done their training. The adult, nymph and larval forms will attack man, the adult most readily.

Table I gives information of exposure to or bites from ticks in the two weeks before the onset of the disease. All subjects were exposed. Seven of the 12 are known to have been bitten. In two cases eschars developed at the site of biting by adult ticks (Cases IV and XII). In addition, one man (Case V) said he had been bitten by a "small, hard, grey insect the size of a pin's head". This might have been a larval tick. A larval tick was found engorged on the patient in Case VII who was unaware of this when admitted to hospital; this was identified as *Ixodes holocyclus*. The eschar was about four inches distal to the tick. Four men, although exposed, noticed no tick bites. However, larval ticks, because of their small size, may easily be overlooked, especially under the conditions of strenuous field training, when the clothes may not be removed for some days.

We know, then, that both larval and adult ticks infested these patients, and that the adult tick in two cases conveyed the infection, since eschars developed at the site of biting. Whether larval ticks as well as adults can infect the subject is not known, but seems likely (Case V).

Ten of the 12 cases occurred in August and September, 1944. This was at the time of the early spring rains, when *Ixodes holocyclus* is known to be most abundant on the tableland.

Incubation Period.

The limits of the incubation period cannot be exactly determined, although it is known in some of our cases at what stage symptoms developed after the tick (which produced an eschar) had been removed (Figure I); but it cannot be known how long the arthropod had been attached. *Ixodes holocyclus* adults engorge for four to six days, while the nymphs engorge for four to seven days (Roberts[7]).

If the adult tick in Case IV is assumed to be attached for the maximum period—that is, six days—and that the infection occurred on the first day of biting, the incubation period would be fourteen days. However, if it is assumed that the tick became attached only on the day on which it was found, the incubation period would then be seven days. This possible range of seven to fourteen days applies equally to Case V, in which the symptoms developed seven days after the "insect" (possibly a larval tick) was removed. These men came from the same unit and had camped in the same area. In each case an eschar developed at the site of the bite.

Although in Case II the patient noticed no bites, he had been in the rain forest only seven days before the onset of symptoms. The incubation period, therefore, in his case could not be longer than that period, but may have been shorter.

The patient in Case IX was exposed from the eighth day before the onset; numerous tick bites were present.

Unit training started in the rain forest ten days before the patient in Case XI developed typhus. Eight days befoer the onset an adult tick was removed from the left axilla. No eschar developed, but the lymph gland of the left axilla later became swollen and tender.

These five cases would suggest that seven to ten days is a likely incubation period; but these figures probably do not represent the extreme range. This period conforms with the incubation period of some other types of tick typhus.

Clinical Features.

The onset of the disease in most cases could be fixed to one day. The men in this series were admitted to hospital on an average of 4·2 days from the onset (range one to nine days).

The first complaint was of some malaise and headache, which gradually increased in intensity. All in this series complained of headache, which was bilateral, frontal and frequently retroorbital (Table I). In three cases slight shivers were noticed. Four men complained of generalized aches and pains. Other symptoms were inconstant and infrequent.

Of the signs, adenopathy was constantly present. The regional glands draining the eschar were usually considerably enlarged, a little painful and somewhat tender. Examination of glands remote from these areas in 11 patients revealed enlargement which persisted for seven to ten days.

In nine cases an eschar was found. The macroscopic appearance differed in no particular from eschars seen in cases of scrub typhus. The sore started as a raised, red papule which became vesicular and ruptured. The centre then became dark purplish, finally black, and was seen as a slough surrounded by raised edges, which in turn was surrounded by a small erythematous zone. A fully developed eschar was nearly always present when the patient was first examined. A biopsy of the eschar in Case VII on the seventh day of illness revealed a similar histopathological picture to an eschar of scrub typhus.

In two cases the spleen was palpable. Neither of these men had been exposed to malaria.

The fever was continuous or remittent, with occasional intermissions. The temperature usually subsided by lysis after an average total febrile period of 7·5 days (range two to twelve). High and persistent fever was not a feature of the disease. The pulse rate was a little slow in proportion to the temperature.

A rash appeared in 11 cases. In nine of these, on which the day of appearance is known with certainty, an average of 3·5 days elapsed from the onset of symptoms (range one to six). No particular area was noted as its commencing point, though the trunk was always involved when the rash was first observed. The rash was not irritable. Great variation in the character of the rash occurred from case to case. The individual lesions varied in size, colour, degree of elevation and density of distribution. In some cases they consisted of small, sparsely scattered, erythematous macules and papules. In one case the lesions were macular only. In other cases the rash consisted of large and slightly dirty pink papules similar in appearance to those commonly seen in scrub typhus. In one such case (Case V) these lesions became confluent on the trunk to form large purplish blotches, around which smaller satellite lesions subsequently appeared. In this case distribution was general, the rash involving the face, the scalp and the palms of the hands. In another (Case IV) the lesions, sparsely scattered on the trunk and extremities, were sharply papular and a few capped with tiny vesicles. On superficial examination this rash could have passed for that of early chickenpox. Indeed, one patient was sent to hospital with this diagnosis, made by his medical officer. The rash disappeared soon after the fever subsided.

In general the disease was mild, and no case gave rise to any anxiety.

The detailed history of the first case in which rickettsiæ were isolated is as follows.

CASE IV.—Lieutenant F.I.K., aged twenty-seven years, had been on an exercise in the jungle. On September 5, 1944, a tick was removed from the skin over the upper border of the trapezius under the supervision of his regimental medical officer. The tick was small and hard and

TABLE I.
Epidemiological, Clinical and Laboratory Features of North Queensland Tick Typhus.

Name of Patient	Day of Disease	Insect Bites	Probable Area	Symptoms.	Signs.	Fever.	Weil-Felix Titres.	Leucocytes

TABLE I.

Epidemiological, Clinical and Laboratory Features of North Queensland Tick Typhus.

Case Number.	Name of Patient; Age in Years.	Day of Disease when Admitted to Hospital.	Insect Bites or Recent Exposure.	Probable Area and Month of Infection.	Symptoms.			Signs.			Fever.		Weil-Felix Titres.				Leucocytes per Cubic Millimetre. (Day.)	Remarks.
					Headache.	Shivers.	Others.	Eschar. (Site.)	Glands.	Rash. (Day of Appearance.)	Highest Temperature. (° F.)	Days Over 99° F.	Day of Disease.	OX19.	OXK.	OX2.		
I	STS. (26)	5	Numerous tick and mite bites.	Wondecla, March, 1944.	+	–	Myalgia.	+ (penis)	+	+ (6)	100	6	15 25	0 160	20 0	0 0	7,800 (6)	Mild.
II	LIR. (32)	3	Jungle exercises one week before onset. No bites noticed.	Milla - Milla, August, 1944.	+	+	–	+ (abdomen)	+	+ (3)	100·8	5	10 17 33	320 1,280 640	60 40 20	(Not estimated) 320	6,400 (3)	Moderate.
III	MAN. (27)	6	Exposed to ticks. "Insect" bite four days before onset.	Ravenshoe, August, 1944.	+	–	Myalgia.	+ (arm).	+	+ (3)	101·4	8	14 41	640+	20 20	(Not estimated) 20	7,200 (8)	Very mild. Eschar developed where "insect" bit him on arm. Spleen enlarged one finger's breadth below costal margin. Never exposed to malaria.
IV	FIK. (27)	5	Tick removed. Eschar developed at site six days later.	Wondecla, September, 1944.	+	–	Photophobia, conjunctivitis.	+ (neck)	+	+ (2)	100·6	8	7 11 17 24	80 160 320 320	40 80 40 80	40 40 160 80	4,600 (6)	Moderate. Rickettsia isolated by means of mice and guinea-pigs, sixth day of disease.
V	PHS. (30)	4	"Insect" size of pin's head removed. Eschar developed at site six days later.	Wondecla, September, 1944.	+	+	–	+ (ear)	+	+ (5)	102·0	8	6 13	40 640	40 80	40 40	6,200 (5)	Mild. Rickettsia isolated by means of mice and guinea-pigs, sixth day of disease.
VI	COL. (21)	2	Three ticks removed nine days before onset.	Mapee, September, 1944.	+	–	–	–	+	+ (2)	102·4	6	7 12 30	20 640 1,560	20 20 20	(Not estimated)	6,300 (4)	Very mild.
VII	WHD. (22)	3	Larval *Ixodes holocyclus* removed from axilla.	Wondecla, September, 1944.	+	+	Myalgia.	+ (arm)	+	–	104·0	8	8 13 18	40 320 640	60 30 20	0 80 80	4,500 (4)	Moderate. Sections of eschar; similar to scrub typhus eschar macroscopically and microscopically (biopsy).
VIII	DAE. (26)	5	Exposed to ticks. No bites noticed.	Wondecla, September, 1944.	+	–	–	–	+	+ (5)	–	4	12 17	40 80	40 30	160 320	8,300 (7)	Very mild.
IX	McL. (29)	9	Numerous tick bites eight days before onset.	Ravenshoe, September, 1944.	+	–	Vomiting.	+ (back)	+	+ ? (9)	101·0	12	10 18	0 320	20 30	0 0	5,800 (10)	Mild.
X	CHE. (33)	1	Exposed to ticks. No bites noticed.	Wondecla, September, 1944.	+	–	–	+ (neck)	+	+ (6)	102·8	8	9 14 19	0 320 640	20 30 20	(Not estimated) 160 160	3,700 (5)	Mild.
XI	CHR. (21)	5	Tick removed eight days before onset.	Milla - Milla, November, 1944.	+	+	–	–	+	+ (1)	101·4	9	13 20	320 640	30 40	0 0	6,350 (9)	Mild.
XII	BAN. (25)	Casualty clearing station, 2; Australian general hospital, 9.	Tick removed. Eschar developed at site.	Kairi, February, 1945.	+	–	Myalgia.	+ (neck)	+	+ (uncertain)	101·0	8	10 16	0 160	0 0	160 640	4,500 (7)	Mild.

was removed with difficulty, which suggests that it was a larval form. The species was not identified. Five days later a sore was noticed at the site of removal of the tick. In a further two days the left cervical glands became painful, swollen and tender, and malaise and slight headache appeared. Constitutional symptoms became progressively worse over the next three days, by which time a rash had appeared on the shoulders and on the upper part of the chest. The following day the patient was admitted to hospital complaining of photophobia, sore eyes and intense headache.

Soon after his admission to hospital his temperature was 100·6° F. (Figure 1), his pulse rate was 100 per minute, his face was flushed and his conjunctivæ were injected. Over the upper border of the left trapezius there was an eschar with a central black slough. The glands of the left posterior

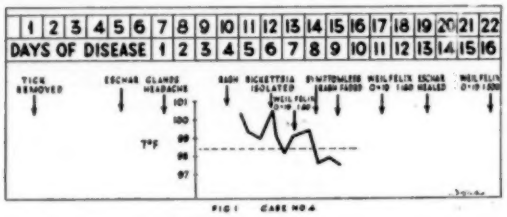
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
DAYS OF DISEASE 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
TICK REMOVED
ESCHAR GLANDS HEADACHE
RASH RICKETTSIA ISOLATED
WEIL-FELIX ESCHAR HEALED
T°F
101
100
99
98
97

FIGURE I. Case IV.

cervical group were enlarged and tender, the largest being about the size of a starling's egg. Other groups of glands were all readily palpable, but were considered to be within the upper limit of normality. The spleen was not palpable. Sparsely scattered over the trunk and arms was a rash composed of pink papules. On close inspection a few of the papules were found to be surmounted by tiny vesicles, just discernible with the naked eye. This rash superficially resembled that of early chicken-pox. The following day headache was severe, but in the afternoon the temperature fell. On this day, the sixth of the patient's illness, a white cell count showed a total of 4,600 cells per cubic millimetre, of which 63% were neutrophile cells and 37% lymphocytes, and rickettsiæ were recovered from one millilitre of blood injected intraperitoneally into mice (*vide infra*). The next

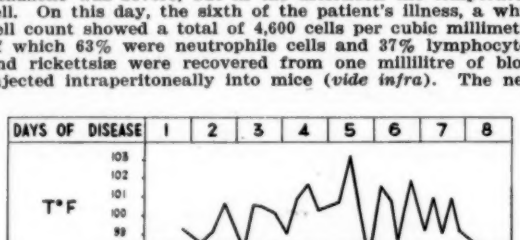

FIGURE II. Case X.

day symptoms and temperature were rapidly subsiding. The Weil-Felix test showed agglutination of *Bacillus proteus* OX19 to a titre of 1:80. The following day the patient felt and looked well. The white cell count had risen to 6,500 per cubic millimetre, while the differential count revealed an increase of lymphocytes (neutrophile cells 54%, lymphocytes 40%, monocytes 2%, eosinophile cells 4%). One day later the rash had faded and the cervical glands were reduced in size and no longer tender. Eleven days after the onset of constitutional symptoms the Weil-Felix titre was 1:160 against *Bacillus proteus* OX19. On the sixteenth day the titre had risen to 1:320 with *Bacillus proteus* OX19 and to 1:160 with *Bacillus proteus* OX2. On this day the patient was discharged to duty. One week later the Weil-Felix test revealed a drop in titre with *Bacillus proteus* OX2 to 1:80, but no change with *Bacillus proteus* OX19.

The salient features of this case history are summarized in Figure I. Figure II shows the temperature chart of the only patient (Case X) admitted to hospital on the first day of illness.

Weil-Felix Agglutinations.

At this hospital the Weil-Felix test has been carried out by means of the standard technique. In one laboratory 274 tests have been made over a period of sixteen months. If all forms of typhus are considered together and if no discrimination is made between the three strains of *Bacillus proteus* suspension used, then results obtained are as follows. A titre of 1 : 320 or higher has been found 51 times, and in every instance the clinical diagnosis of typhus was obvious. A titre of 1 : 320 was thus found to be diagnostic of the typhus group. The significance of a single test revealing an agglutination of 1 : 160 is not so definite; however, a rise of titre to this level during the course of an illness has been found to be diagnostic. When the three strains of *Bacillus proteus* are considered separately, then it has been found that in scrub typhus a higher titre was invariably present with OXK, while in murine typhus the maximum titre was obtained with OX19. In this series of 274 tests, agglutination of OX2 was uncommon. A titre of 1 : 320 was obtained once, and that in a possible case of North Queensland tick typhus. A titre of 1 : 160 with OX2 was obtained five times, once in tick typhus (Case IV), in which the titre to OX19 was greater, and four times in scrub typhus, in which the titre to OXK was invariably higher. At the other hospital *Bacillus proteus* OX2 agglutination tests were performed in seven cases of murine typhus. In two agglutination tests a titre greater than 1 : 160 was found.

From Table I it will be noted that of the 12 cases of North Queensland tick typhus, in nine a diagnostic titre of 1 : 320 or higher was found with OX19, and in three of these the titre was 1 : 160 or greater with OX2. Of the remaining three cases, one showed a rise from 0 to 1 : 160 with OX19, and two showed a titre of 1 : 320 and 1 : 640 respectively with OX2.

When the findings from the two hospital laboratories are considered together, a titre of 1 : 160 or greater with OX2 was found 12 times. Five of these instances occurred amongst the 12 cases of tick typhus reported, and one other occurred in a doubtful case of the disease. The conclusions drawn from this small series are that a titre of 1 : 160 or greater with OX2 is strongly suggestive of tick typhus, but may occur in murine typhus. When this titre is obtained in scrub typhus, the titre with OXK is always higher.

In the 12 cases of North Queensland tick typhus reported the Weil-Felix reaction has been found positive in all. This high percentage is possibly due to the fact that several doubtful cases of the disease have not been included in this report. It is probable that the percentage of positive results will ultimately be found to be comparable with the results in other forms of typhus.

Rickettsia-Agglutination and Complement-Fixation Tests.

We are greatly indebted to Colonel Harry Plotz, of Washington, D.C., to whom serum was sent, for performing these tests. The results for five cases appear in Table II. For comparison, the results in two cases of murine typhus appear at the end of the table. From both these murine cases a Rickettsia was isolated which gave a Neil-Mooser reaction in guinea-pigs. From these tests it would appear that the strain of Rickettsia responsible for murine typhus in North Queensland is the same as that used in Colonel Plotz's laboratory, but that the strain causing North Queensland tick typhus is serologically different from the Rickettsia for which the test was performed—namely, epidemic typhus, murine typhus, *fièvre boutonneuse*, South African tick bite fever and Rocky Mountain spotted fever.

Isolation of Rickettsia.

Rickettsiæ were demonstrated in the blood of two patients (Cases IV and V) by animal inoculation on the sixth day of their disease. The same results were obtained in each case. One millilitre of freshly drawn blood was inoculated intraperitoneally into white mice which had been maintained for some time on a vitamin-deficient diet. After seven days the mice were killed, and post-mortem examination revealed enlargement of the spleen and abdominal glands and a small amount of fibrinous exudate lying between loops of bowel. In smears made from the

TABLE II.
Rickettsia Agglutination Tests.

Case Number.	Name of Patient.	Rickettsia Agglutination.			Complement Fixation.				
		Day of Disease.	Epidemic.	Murine.	E.[1]	M.[1]	F.B.[1]	S.A.T.B.[1]	R.M.S.F.[1]
IV	FIK.	11	0	0	0	0	0	0	0
V	PHS.	13	0	0	0	0	0	0	0
VII	WHD.	23	80	0	0	0	0	0	0
X	MAN.	41	0	0	0	0	0	0	0
XI	MCL.	23	0	0	0	0	0	0	0
Murine typhus I ..	JOS.	38	1,280	10,240	0	60	0	0	0
Murine typhus II ..	PAN.	42	320	5,120	0	80	0	0	0

[1] E.: epidemic; M.: murine; F.B.: *fièvre boutonneuse*; S.A.T.B.: South African tick bite fever; R.M.S.F.: Rocky Mountain spotted fever.

exudate and from the peritoneum, and stained by Leishman's and Castaneda's stain, numerous large mononuclear cells were found, some of which contained small rod-shaped intracytoplasmic inclusion bodies. These bodies, measuring approximately 0·3μ to 0·5μ in length, stained purple with Leishman's stain and blue with Castaneda's stain, and in appearance resembled *Rickettsia mooseri*. Some morphological variation was observed, particularly in the length of the bodies, and diplo-bacillary forms were seen.

A suspension of mouse spleen tissue and peritoneal scrapings was then inoculated intraperitoneally into guinea-pigs, which, after an incubation period of four or five days, showed fever and a pronounced scrotal reaction. The temperature rose from the normal level, which did not exceed 103° F., to 105° F. or higher, and continued for three or four days. The scrotal reaction reached its maximum on the second day of fever, being characterized by a tense, painful, reddened swelling involving the whole scrotum, which prevented the testes from being reduced. The animals did not appear specially ill during the fever, and when the infection was allowed to run its course, they recovered with complete disappearance of the scrotal lesions. In guinea-pigs sacrificed at the height of the fever, at autopsy only a slight enlargement of the spleen and abdominal glands was found, with no obvious peritoneal exudate or free fluid. In the tunicæ intense hæmorrhagic congestion was present, and they were coated with an adherent fibrino-purulent membrane. In smears from this membrane numerous intracellular rickettsiæ were found, which presented the same characters as those seen in the mouse preparations. In spite of repeated examinations, no intranuclear forms were recognized.

Both strains of Rickettsia became firmly established in guinea-pigs and were maintained for several intraperitoneal passages before being dispatched to the Walter and Eliza Hall Institute, Melbourne, where further investigations are in progress under the direction of Dr. F. M. Burnet.

During the course of these investigations an opportunity occurred to isolate two further strains of Rickettsia from cases clinically diagnosed as of murine typhus (Table II). These were obtained by intraperitoneal inoculation of blood into guinea-pigs, which reacted with fever and scrotal swelling on the tenth and eleventh days after inoculation. Although no rickettsiæ were seen in the first passage, subsequent passages produced intracellular organisms whose morphology and pathogenicity corresponded closely with those of *Rickettsia mooseri*. Splenic enlargement was more pronounced and the rickettsiæ were less numerous when these strains were used than had been observed when the tick typhus strains were used.

Diagnosis.

Help in the diagnosis of this condition could be gained from a detailed inquiry into the movements of the patient in the three weeks before the onset. In all cases it was found that the patient had been exposed to tick bites, and the majority were aware of having been bitten.

The onset is fairly gradual, the symptoms being similar to that of many fevers. Of the signs, an eschar, enlarged glands and a rash make a diagnosis of typhus certain. The differentiation from scrub typhus is considered later. However, some patients show no eschar and a rash may not appear. A clinical diagnosis then becomes difficult, if not impossible, and must await the result of a Weil-Felix test towards the end of the second week. Rickettsia-agglutination tests promise to be useful adjuvants in laboratory methods of diagnosis. Blood counts are of some help, in that the total and differential white cell counts produce essentially normal results.

Guinea-pig inoculation in the first few days of the disease may be successful.

Differential Diagnosis.

Murine and Scrub Typhus.—Table III shows the contrasting points in the three forms of typhus contracted in this area over the same period. It will be noted that in murine typhus there is no eschar and that glands are seldom involved. Adenopathy has never been a feature of murine typhus in Australia (Hone,[1] Wheatland,[2] Adey[3]).

Scrub typhus has many features in common with tick typhus, notably the eschar and enlarged glands. Scrub typhus is a severe disease, complications are frequent, and it has a mortality rate of about 8% to 10%. Tick typhus, on the other hand, is always a mild disease, and thus a

TABLE III.
Contrast between Scrub, Murine and North Queensland Tick Typhus occurring on the Atherton Tableland.

Disease.	Number of Cases.	Symptoms and Signs.				Average Days of Fever over 99° F. (Range.)	Result of Weil-Felix Test.		
		Headache.	Eschar.	Enlarged Glands.	Rash. (Average Day of Appearance.)		OX19.	OXK.	OX2.
Scrub typhus ..	21	21	14	20	17 (5·6)	15·5 (9 to 32)	−	+	−
Murine typhus ..	13	13	0	1	12 (5·5)	14·3 (7 to 25)	+	−	±
North Queensland tick typhus.	12	12	9	12	11 (3·5)	7·5 (2 to 12)	+	−	±

differentiation can be made by a study of the clinical course in most cases. However, scrub typhus sometimes, though rarely, occurs in a mild form. One of us[9] has reported a case in which minimal symptoms persisted for three days only and in which the agglutination titre to *Bacillus proteus* OXK was 1 : 1,600. In the absence of an epidemic of either disease, the differentiation of such mild cases from tick typhus must depend on the Weil-Felix test, rickettsia-agglutination or animal inoculation.

Other Diseases.—In other diseases enumerated below there is no eschar and the Weil-Felix test produces a negative result. Dengue does not occur on the Atherton Tableland and therefore presented no difficulty to us. Rubella and morbilli can be differentiated by the history and clinical findings, particularly during an epidemic. Infectious mononucleosis presents a characteristic blood picture, and the Paul-Bunnell test produces a positive result in the majority of cases. Epidemic polyarthritis, recognized by Sibree[10] on the Atherton Tableland in 1944, is characterized by joint involvement, a manifestation not found in tick typhus, though the malaise, headache, rash and enlarged glands are features of similarity.

Pyrexia of Unknown Origin.—During the period under review an intensive study has been made of fevers of unknown origin. Serological tests carried out were the Widal, the Weil-Felix, and the Paul-Bunnell tests, and agglutination tests for "Q" fever, brucellosis and leptospirosis, the five strains of leptospira recognized in Queensland being used in the last-mentioned test. Repeated total and differential white corpuscular counts were made and culture of microorganisms from the blood was attempted. In a few cases gland biopsies and guinea-pig inoculations were carried out. On one occasion mouse inoculation led to the recovery of a murine strain of psittacosis virus, and this in turn to the performance in a number of cases of psittacosis complement-fixation tests, which gave negative results. In spite of these investigations, there remained a few cases in which no diagnosis was established. Some of these may have belonged to the typhus group of fevers; but in the absence of clinical signs and a Weil-Felix reaction they cannot as yet be included in that group. The differentiation of these obscure fevers is one of exclusion.

Summary.

A disease, tentatively named North Queensland tick typhus, has been described. On strong circumstantial evidence it is thought to be transmitted by the adult, and also possibly by the larval tick of *Ixodes holocyclus*. There is an incubation period of seven to ten days, followed by the development of an eschar, enlarged glands, malaise, headache, fever and a rash. The disease is mild, runs a course of approximately a week, and subsides by lysis. There are no complications or sequelæ. The Weil-Felix test produces agglutination with *Bacillus proteus* OX19 and in some cases with *Bacillus proteus* OX2. *Bacillus proteus* OXK is not agglutinated. The method of isolation of the causative strain of Rickettsia has been described. Further work on this Rickettsia by others workers is proceeding. The Rickettsia produces the Neil-Mooser scrotal reaction in guinea-pigs. Rickettsia-agglutination tests and complement-fixation tests suggest that it may be a strain hitherto undescribed. The differentiation between North Queensland tick typhus, scrub typhus and murine typhus has been discussed.

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NORTH QUEENSLAND TICK TYPHUS: A COMPARATIVE STUDY OF THE RICKETTSIA WITH THAT OF MURINE TYPHUS.

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AMONGST cases of typhus-like fever occurring in North Queensland, and in which an increase in titre was observed in the Proteus OX19 agglutination reaction, Andrew, Bonnin and Williams[1] differentiated a type which on clinical and epidemiological grounds appeared to be a tick-borne form of typhus.

The present studies were undertaken to compare the laboratory behaviour of the tick typhus strains FIK and PHS (isolated from Cases IV and V of the series of Andrew *et alii*) with that of strains isolated from cases of murine typhus, the only other disease occurring in the region in which positive Proteus OX19 reactions are known to be obtained.

Specific fixation, obtained by Colonel H. Plotz[2] with samples of serum PAN and JOS, established that the strains isolated from these cases and used in our studies were murine in type. Specimens of serum from representative cases of tick typhus failed to give fixation with a variety of rickettsial suspensions, and it was therefore necessary to show that the tick typhus group of infections gave uniform serological results in relation to the rickettsiæ isolated from patients and presumably responsible for the disease.

For convenience, the FIK and PHS strains are referred to as tick typhus strains, although the validity of such a term will need to be established by further work in the field.

The strains were established in guinea-pigs in North Queensland, and infected animals (second to fourth passage) were dispatched to this institute. A suspension prepared from the *tunica vaginalis*, at the height of the scrotal reaction, was used to begin culture in the yolk sac of the chick embryo, and the strains were maintained thereafter by serial yolk sac passage. In the early stages of the work, the strains were also maintained in guinea-pigs by serial intraperitoneal passage of tunic suspension. At frequent intervals culture of infective suspensions in serum broth and on blood agar has been made to exclude bacterial contamination, and constant precautions have been taken to prevent mixture of the strains.

Culture in the Yolk Sac of the Chick Embryo.

The method of Cox[3] has been used, namely, serial passage of yolk sac suspension into the yolk mass of the developing chick embryo. Five to seven (usually six) day old eggs were inoculated with 0·3 millilitre of a 5% to 10% suspension of yolk sac in 10% horse serum and saline solution. Yolk sac smears were stained by Machiavello's method or with Leishman's stain, the former method being more satisfactory for routine work. In the early stages of the work eggs inoculated with all four strains were incubated at 35° C. Later, the effects of incubation at 32° C. and 37° C. were tried. As one of the main purposes of culture of the strains was the provision of infected yolk sacs as a source of rickettsial body antigen, the temperature of incubation which appeared to give maximal growth of rickettsiæ, as judged by yolk sac smears, was used for subsequent culture.

With all strains there was considerable variation in the survival time of the embryos and in the degree of rickettsial growth. In an attempt to obtain uniform and abundant growth, study was made of the influence of two factors: (i) the rickettsial content of the inoculum as judged by smears of the yolk sac, and (ii) the time in relation to embryonic death at which the yolk sac was harvested—that is, trial, as transfer material, of embryos which were active or sluggish or had been dead for less than twenty-four hours. However, we were unable to establish any combination of the above factors by which uniformly good growth could be assured. A fairly constant finding was that of eggs receiving the same inoculum; those surviving longest showed most abundant growth.

Details of the findings with the two groups of strains are given below, and it will be seen that the tick typhus strains cause earlier death of the embryo and produce less abundant growth of rickettsiæ than the murine strains.

FIK Strain.

The initial series of yolk sac culture of this strain was terminated in the thirteenth passage by bacterial contamination. A second series, begun from tunic material of a guinea-pig of the fourth passage, was discontinued voluntarily after 119 passages.

When incubation is at 32° C. the embryos die usually on the third or fourth day (more often the latter), only a small proportion surviving until the fifth day. When incubation is at 37° C. the average survival time is lengthened; deaths still occur most frequently on the fourth day, but approximately equal proportions die on the third and fifth days, and a small proportion survives until the sixth day.

In the earlier passages, in yolk sac smears from moribund or recently dead embryos, no rickettsiæ or few rickettsiæ per field were commonly found, and 100 to 200 rickettsiæ per field were found only occasionally. In later passages, smears without rickettsiæ were infrequent, smears containing 100 to 200 organisms per field were common, and occasional smears contained growth of the order of 1,000 rickettsiæ per field. No certain difference in degree of growth was established between batches of eggs receiving the same inoculum and incubated at 32° C., 35° C. and 37° C. Our impression was that growth at 32° C. was slightly better, and this temperature was adopted for routine cultivation. In slightly or moderately infected yolk sacs, the rickettsiæ showed characteristic pleomorphism—cocco-bacillary, short bacillary and diplobacillary forms were present. When growth was heavier, the average size of the organisms became smaller and the diplo-bacillary forms relatively scanty.

PHS Strain.

Yolk sac culture of strain PHS was allowed to lapse after 76 passages. The findings were substantially the same as those for the FIK strain.

Murine Strains.

At the three temperatures of incubation studied, embryos infected with the murine strains had a longer average survival time than those infected with the tick typhus strains. The temperature of 37° C. was selected for routine incubation, as at this temperature rickettsial growth was most abundant. When incubation was at 37° C., death of the embryo occurred most frequently on the fifth or sixth day, although in batches of eggs receiving different inocula there was wide variation in the mean survival time, and survival to the tenth to fourteenth day was not infrequent. Smears containing countless rickettsiæ per field were common, and growth was in general much more abundant than that of the tick typhus strains. In smears showing abundant growth, the rickettsiæ were much smaller than those seen in smears showing good growth of the tick typhus strains. Apart from these minute forms, correlated with the more abundant growth of the murine organisms, no certain difference in size and morphology between the two groups of strains was observed.

Culture of the tick typhus strains on the chorio-allantoic membrane of the chick embryo was studied, infective yolk sac suspension being used as inoculum. Growth was variable under these conditions, and no attempt was made to adapt the strains to the chorio-allantois by serial passage of infective membrane. Inoculation of serial dilutions of yolk sac suspensions sometimes yielded membranes showing well-defined, countable lesions; but the results were too irregular for the method to be of value in titration of suspensions.

Growth of the tick typhus strains in the yolk sac of the duck embryo was also studied. Eggs of Indian Runner ducks, after incubation at 39° C. for seven or eight days, were inoculated with infected suspension of the chick or duck yolk sac and incubated at 32° C. The mean survival time of the embryos was approximately one day greater than in the case of the chick embryo. Rickettsial growth appeared to be more abundant than in the chick yolk sac, and specific complement-fixing suspensions were prepared from infected duck yolk sacs. However, culture of the strains in the duck egg was discontinued because of the difficulty of obtaining a constant supply of fertile eggs.

The Experimental Disease in the Guinea-Pig.

With all four strains, the signs of infection, following intraperitoneal inoculation in the guinea-pig are fever and a scrotal reaction. The account given below describes the infection in guinea-pigs maintained by serial passage in the following manner. Within forty-eight hours of the onset of the scrotal reaction the guinea-pig was killed; the testes and coverings were removed, the parietal and visceral tunics were pooled, ground with an equal volume of powdered quartz and suspended in 10·0 millilitres of serum and saline solution; 3·0 millilitres of the suspension were injected intraperitoneally into one or more male guinea-pigs approximately 500 grammes in weight. The temperature of the animals was taken at least once a day, and usually twice; 103·5° F. was taken as an approximate normal upper limit of temperature. Tables I and II indicate the frequency of pyrexia, scrotal reaction and the association of these features.

It will be seen from Tables I and II that with all strains, in the majority of the animals pyrexia and scrotal reaction occurred. Animals of the PHS II series showed weaker temperature reactions than those of other groups, and no attempt was made to continue the series from the single animal of the fifth passage, which showed no clinical reaction. The PAN and PHS I series were discontinued voluntarily. The JOS and FIK series ended by the failure in each case of the single animal of the fifteenth passage to react. Our impression is that, with precautions to cover occasional non-reacting or weakly reacting animals, all four strains can be maintained without difficulty in guinea-pigs.

Most of the animals in these series were killed for passage at the height of reaction. In the small number of animals in each group in which the infection was allowed to run its course, no certain difference between the clinical features produced by the various strains was established, and the following account applies to all four strains.

The pyrexia varied in its duration, usually lasting for two to four days. A "saddle-back" curve was met fre-

TABLE I.

Occurrence of Pyrexia in Experimentally Infected Guinea-pigs.

Strain.	Number of Animals.	Number of Passages.	Average Incubation Period. (Days.)[1]	Maximum Temperature Observed. (Degrees Fahrenheit.)			
				Less than 103·5°.	103·5° to 104°.	104° to 105°.	105° to 106°.
Tick typhus:							
FIK	26	15	4·9	3	3	18	2
PHS, Series I	5	5	4·7	—	—	3	2
PHS, Series II	9	5	6·2	4	2	2	1
Murine:							
PAN	26	16	4·7	1	2	16	7
JOS	26	15	5·1	4	4	11	7

[1] Calculated from the number of animals showing a temperature of 103·5° F. or higher.

TABLE II.

Strain.	Number of Animals.	Number of Passages.	Scrotal Reaction.		No Scrotal Reaction.	
			T+[1]	T−[1]	T+	T−
Tick typhus:						
FIK	26	15	21	2	2	1
PHS, Series I	5	5	5	—	—	—
PHS, Series II	9	5	5	3	—	1
Murine:						
PAN	26	16	23	1	2	—
JOS	26	15	21	2	1	2

[1] "T+" = temperature of 103·5° F. or higher; "T−" = temperature less than 103·5° F.

quently—an initial rise, with a fall to within normal limits on the following day, and a secondary rise maintained for a day or more. As the more strongly reacting animals were killed for passage at the height of reaction, the above estimate of the duration of pyrexia is probably a little low. The temperature charts and findings in regard to scrotal reaction for two animals showing moderate reactions to the FIK and PAN strains respectively are given in Figure I.

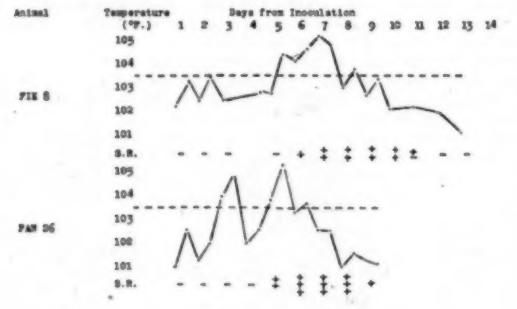

FIGURE I.

Degree of scrotal reaction (S.R.) indicated by number of "+" signs.

The onset of the scrotal reaction usually accompanied, or followed within twenty-four hours, the onset of pyrexia, and rarely preceded it. The scrotal reaction consisted, as described by Andrew *et alii*,[3] in a "tense, painful, reddened swelling involving the whole scrotum, which prevented the testes from being reduced". There was considerable variation in the intensity of the swelling, which lasted from one to ten or more days. Resolution of the inflammation was usually complete, some thickening of the scrotal tissues occasionally persisting. The animals appeared to suffer no general reaction, apart from the fever, and no deaths attributed to typhus occurred in these series. The findings at post-mortem examination of animals killed at the height of the reaction were inflammatory changes in the tunics and a thin exudate on the spleen frequently with the murine strains, rarely with the tick typhus strains. In the tunics a considerable degree of congestion and an adherent rather thick, cream-coloured membranous exudate were present. The changes were more striking in the parietal layer, and the body of the testis appeared to be little affected. In smears of the tunic exudate rickettsiæ including intracellular forms could usually be found without difficulty. Intranuclear rickettsiæ were not seen. The intracellular forms of the murine strains appeared most frequently as clusters of varying density. In heavily infected cells a dense cluster of minute organisms appeared to occupy the whole cytoplasm and to distend the cell. With the tick typhus strains, on the other hand, the rickettsiæ, though often numerous, were distributed diffusely throughout the cytoplasm, and no appearance of distension of the cells by the organisms was observed. Alexander, Mason and Neitz[4] have reported a similar cytological distinction between a murine strain and strains of two tick-borne forms of typhus, *fièvre boutonneuse* and South African tick bite fever.

With all strains, intraperitoneal injection of an infected yolk sac suspension produced a similar, but usually more intense, reaction in the guinea-pig. There appeared to be a slight decrease of virulence for the guinea-pig in yolk sac suspension, with continued passage of the strains in eggs.

Cross-Immunity Tests in Guinea-Pigs.

Study of the immunological relationship of the two groups of strains was carried out in conjunction with the maintenance of the strains in guinea-pigs. Animals infected with tunic suspension of the tick typhus strains were inoculated at varying intervals after the primary infection with tunic suspensions of the murine strains, and *vice versa*.

Ten animals infected with the tick typhus strains were challenged with controlled murine suspensions at an average interval of forty-nine days from primary inoculation (range twenty-two to one hundred days). Two showed no reaction. Of the remaining eight, four developed a moderate degree of pyrexia (one with a moderate and one with a weak scrotal reaction), and four showed a low-grade pyrexia (one with a moderate scrotal reaction).

Eleven animals infected with the murine strains were challenged with controlled tick typhus suspension at an average interval of twenty-three days from primary inoculation (range sixteen to thirty-three days). Three showed no reaction and one a mild typical reaction

(pyrexia and scrotal reaction). Of the remaining seven animals, two developed mild scrotal reactions, four showed doubtful scrotal reactions, and one developed a low-grade temperature without scrotal reaction.

Two animals infected with the FIK strain were challenged with the FIK strain after twenty-eight days and with the PHS strain after twenty days respectively. Two animals infected with the PHS strain were challenged with the FIK strain after forty to forty-three days respectively. No reactions occurred in the challenged animals.

In the above groups, when the animals showed some reaction to the challenging inoculum, this response was always less intense, and in nearly all cases much less so, than that occurring in control animals. This finding, in conjunction with the failure of some animals to show any reaction, indicates that under the conditions of our tests, infection with the tick typhus strain confers a partial immunity to subsequent infection with the murine strains, and *vice versa*.

Studies of Infection in the White Rat.

Philip and Parker[5] have studied the persistence in the brain of the white rat of the rickettsiæ of murine typhus and of two forms of tick-borne typhus, Rocky Mountain spotted fever and *fièvre boutonneuse*. The murine rickettsiæ were shown to persist for varying intervals, up to a year or more. With the exception of the survival in one instance of the spotted fever strain for thirty days after infection, persistence in the rat brain of the rickettsiæ of spotted fever or *fièvre boutonneuse* was not demonstrated for periods of thirty days (the shortest interval tested) or longer. The behaviour of our four strains was investigated in this regard. Adult male white rats were inoculated intraperitoneally with 1·0 millilitre of a tunic or yolk sac suspension, the infectivity of which was controlled by guinea-pig inoculation. After varying intervals the rats were killed, the brain was removed aseptically and ground with powdered quartz and serum and saline solution, and an amount of the suspension equivalent to approximately one-quarter of the brain was injected into a guinea-pig. Three to seven weeks later, animals showing no reaction or a doubtful reaction were challenged with a controlled tunic or yolk sac suspension of the homologous strain. Table III presents the findings.

TABLE III.

Persistence of Strains in the Brain of the White Rat.

Interval from Inoculation of Rat to Brain-Transfer. (Days.)	Strain.			
	Tick Typhus.		Murine.	
	FIK.	PHS.	PAN.	JOS.
9				+[1]
11			+	
13	−[1]			
15	−	−	+	+
23		−		+
25		−, −		
28	−	−		
32	−, −		+	
33	−, −			
52				−
60			+, −	
63				+, +
258				+
280				−

[1] "+" = persistence of strain in brain demonstrated; " " = persistence of strain in brain not demonstrated.

It will be seen that persistence of the murine strains was demonstrated in ten of thirteen tests, and that in none of the twelve tests with the tick typhus strains was the rickettsia recovered.

In the tests in which persistence of the murine strains was considered to have been established, the animals receiving brain suspension showed frank febrile and scrotal reactions, except in the test of the PAN strain at sixty days. In this case, the test animal reacted with a fever lasting for five days, without scrotal involvement. Seven weeks after the brain transfer, challenge with a controlled yolk sac suspension of the homologous strain produced no reaction.

Systematic observation of infected rats was not made, but the following features of infection were noted. Animals receiving the murine strains were frequently visibly affected, showing varying degrees of listlessness and loss of weight. Of 32 rats infected with the murine strains, eleven died. Of these eleven animals, seven had received yolk sac suspension and four tunic suspension of guinea-pigs, which had reacted strongly to yolk sac material. At the few post-mortem examinations made, considerable enlargement of the spleen was found and smears from the splenic surface contained a small number of rickettsiæ. No general reaction was noticed in animals receiving the tick typhus strains. In the course of the tests, it was noticed that rats receiving the tick typhus strains developed a scrotal reaction. Seven rats were inoculated with yolk sac suspensions of the tick typhus strains after this observation was made, and were inspected daily. All showed a scrotal reaction within four to six days of inoculation. Post-mortem examination of two animals killed before subsidence of the scrotal reaction revealed a rather thin, pale tunica exudate, smears of which contained abundant intracellular rickettsiæ.

Tissue Culture Studies of Tick Typhus Strains.

Tissue culture of the FIK and PHS strains was made to determine the general features of growth, with special reference to localization of growth within the cell, and to explore the method as a source of complement-fixing antigen.

The serum-Tyrode-agar medium of Zinnser, Fitzpatrick and Wei[6] was used. Infective yolk sac suspension was added to the minced trunk or viscera of eleven-day chick embryos (two to four drops of suspension per embryo) and the mixture was distributed by means of a wide-bore Pasteur pipette over the culture slopes. At varying intervals a small piece of tissue was removed by means of a platinum loop, and smears were made and stained by Machiavello's method. Leishman's stain was found unsatisfactory for tissue culture smears.

Similar results were obtained with the two strains. In a small number of cultures in which smears were made at intervals of one or two days, it appeared that the rate of rickettsial multiplication increased rapidly from the third or fourth day onwards. Smears made between the seventh and twelfth days contained the greatest number of rickettsiæ. In smears made on the fourth to sixth days, the cells showed a reasonably good degree of preservation, and the features of intracellular growth were most easily studied. Both intranuclear and intracytoplasmic forms were found without difficulty; but the latter forms appeared to be more abundant. The intranuclear forms appeared as clusters of rickettsiæ occupying a variable proportion of the nucleus. At times, the entire nucleus appeared to be packed with rickettsiæ, the nuclear chromatin being just discernible at the periphery of the mass of organisms. Smaller intranuclear clusters showed the same compact arrangement. In contrast with this arrangement within the nucleus, intracytoplasmic forms were distributed diffusely.

In many of the cultures a heavy growth of rickettsiæ occurred, smears made in the second week containing innumerable organisms per oil-immersion field; but too few studies were made to determine the regularity with which abundant growth could be obtained. Specific complement-fixing antigens were prepared by the method of Plotz and Wertman[7] from cultures of the FIK strain, and our impression was that tissue culture material is a more satisfactory source of antigen than infected yolk sac, because of the variability of growth in the latter. However, in our studies, it was found more practicable to combine preparation of antigen with the routine yolk sac cultivation of the strains.

Serological Studies.

The serological relationships of the strains were studied by the complement-fixation technique.

Antigens were prepared from infected yolk sacs, the FIK strain being used for the preparation of the tick typhus antigen, and the PAN strain for the murine antigen. The yolk sacs were harvested after death of the embryos, pooled, ground with powdered quartz and suspended in 0·05% formol saline solution (0·85% saline solution). The supernatant, after removal of coarse tissue particles and silica by centrifugation at 1,000 revolutions per minute for three minutes, was centrifuged at 3,500 revolutions per minute for one hour, and the deposit, containing the bulk of the rickettsiæ, was suspended in formol saline solution containing "Merthiolate" (0·01%). The suspension was then shaken with an equal volume of ethyl ether, the mixture immediately centrifuged and the aqueous phase pipetted off and exposed to reduced pressure to remove the dissolved ether. The suspension was used as antigen without further treatment, or on occasions it was further concentrated by centrifugation at 3,500 revolutions per minute for one hour and suspension of the deposit in a smaller volume of formol "Merthiolate" saline solution. On account of the variation in the rickettsial content of the yolk sacs, steps in the preparation were controlled by smears rather than in terms of the weight of the yolk sacs. Suspensions of the tick typhus strain, used in the tests, represented a degree of concentration of approximately ten yolk sacs per millilitre. Preparation of the murine antigen involved a much smaller degree of concentration because of the abundant growth of this strain in the yolk sac. Antigens were tested in doubling dilutions against samples of serum from human cases of murine and North Queensland tick typhus. Titration of the tick typhus antigen was carried out with two samples, BRY and PHS, which subsequent tests showed to have respectively the highest and a moderate titre, in relation to the other specimens available for study. It was found necessary to use the tick typhus suspensions in a dilution or 1:2 or less, to obtain fixation with the weakly reacting samples.

Because of the difficulty of preparing the tick typhus antigen a micro-technique was used in the fixation test, a "volume" being one drop (approximately 0·05 millilitre) from a dropping pipette. The hæmolytic system consisted of equal parts of 2% washed sheep cells and hæmolysin (five minimum hæmolysing doses per volume). The samples of serum for test were inactivated in a 1:4 dilution at 56° C. for thirty minutes. Pooled guinea-pig serum from two or more animals was used as source of complement. Titration of complement was carried out under the same conditions as those of the test, the titre being taken as the reciprocal of the highest dilution giving complete lysis of cells in the presence of antigen. In the test, to tubes measuring 7·5 centimetres by 1·0 centimetre were added one volume each of serum dilution, complement (containing two minimum hæmolysing doses) and antigen. After fixation at 37° C. for one hour, two volumes of sensitive cells were added and the tubes were returned to the water bath at 37° C. The mixtures were shaken after the addition of each reagent and at intervals of ten minutes after the addition of the sensitized cells. Reading of the test was done half an hour after the addition of the cells. Mixtures showing incomplete lysis were centrifuged and the degree of fixation was gauged from the colour of the supernatant liquid and the amount of the cell deposit. The usual method of recording the results was adopted—"4" corresponding with no hæmolysis, "tr" with a trace of cell deposit and "0" with complete hæmolysis. Mixtures containing one volume each of saline solution, antigen and dilutions of complement equivalent to 0·75, 1·0 and 1·25 minimum hæmolysing doses respectively were included as complement controls. Serum controls, the same dilutions of serum as in the test being used, were included. The titre of a serum was taken as the reciprocal of the highest dilution giving a three or four degree of fixation.

Specimens of serum from human patients with typhus and from experimentally infected guinea-pigs were tested. Diagnosis of the type of typhus in the human cases rested on clinical, epidemiological and serological (Proteus agglutination reaction) grounds. "Merthiolate" (0·01%) was added to the samples as preservative. Specimens of serum were available from seven patients of the series of Andrew *et alii*. The sample BRY was obtained from a patient with a mild attack of tick typhus, who had on the twenty-third day of the illness a Proteus OX2 titre of 320 and Proteus OX19 and OXK titres of 40. Table IV presents the serological findings.

The findings presented in Table IV indicate that the tick typhus strains (FIK and PHS) are serologically similar, and distinct from the murine strains. Further, the demonstration of specific antibodies in the samples of serum from patients with North Queensland tick typhus fulfils a further condition of proof of the ætiological role of the rickettsia in the disease.

The titres of the samples tested were lower than those generally obtained in other rickettsial diseases, and two specimens, including that of the patient (FIK) from whom the strain used in the preparation of antigen was isolated, gave negative results by our criteria. However, the samples of human serum were more than a year old when finally tested, and from preliminary work on the preparation of antigens it was apparent that some loss of complement-fixing antibodies occurred with storage at 4° C.

Our tissue culture studies suggested that, with facilities for culture on a larger scale than was possible in these studies, sufficient antigen for routine diagnostic use could be prepared. The serological findings presented above

TABLE IV.

Serum.	Disease.	Day of Disease.[1]	Tick Typhus (FIK) Antigen. (Serum Dilution.)					Murine (PAN) Antigen. (Serum Dilution.)					
			4	8	16	32	64	4	8	16	32	64	128
Human:													
LIR ..	Tick typhus.	37	4	4	3	1	0	0	0	0	0		
FIK ..	Tick typhus.	22	1	tr.	0	0	0	0	0	0	0		
PHS ..	Tick typhus.	22	4	4	4	tr.	0	0	0	0	0		
COL ..	Tick typhus.	25	4	3	1	0	0	Serum	anticom	plementa	ry at tim	e of test.	
WHD ..	Tick typhus.	23	4	3	1	0	0	0	0	0	0		
DAE ..	Tick typhus.	21	4	4	4	2	0	0	0	0	0		
MoL ..	Tick typhus.	22	2	tr.	0	0	0	0	0	0	0		
BRY ..	Tick typhus.	33	4	4	4	4		0	0	0	0		
PAN ..	Murine typhus.	41	0	0	0	0		4	4	4	3		
JOS ..	Murine typhus.	44	0	0	0	0		4	4	4	4		
ANN ..	Murine typhus.	27	0	0	0	0		4	4	4	4		
Guinea-pig:													
FIK 52 ..	Tick typhus.	23		4	4	3			0	0	0	0	
PHS 41 ..	Tick typhus.	23		4	4	2	0		0	0	0	0	
PAN 45 ..	Murine typhus.	20		0	0	0	0		4	4	4	3	
JOS 40 ..	Murine typhus.	21		0	0	0	0		4	4	4	4	1

[1] Calculated in the case of guinea-pig samples from the height of fever.

indicate that the complement-fixation test with the rickettsial antigen should prove a valuable method in the diagnosis of North Queensland tick typhus.

Conclusions.

The studies recorded above confirm the findings of Andrew *et alii* that cases of typhus occurring in North Queensland, in which agglutinins to Proteus OX19 strains develop, include two types: murine typhus and a type not previously described. Andrew and his colleagues have presented evidence of tick transmission of the latter type. The tick typhus strains show differences of major importance from the murine strains—in serological type, in the characteristics of culture in the yolk sac of the chick embryos, in pathogenicity for the white rat, in the occurrence in tissue culture of intranuclear growth and probably in immunogenic properties.

There appears to be a correlation between intranuclear growth in tissue culture and natural transmission by ticks among rickettsial types. Pinkerton and Hass[8] demonstrated intranuclear growth in tissue culture of rickettsiæ of Rocky Mountain spotted fever, and found no evidence of intranuclear growth in the case of murine typhus rickettsiæ. Plotz[7] has observed intranuclear forms in tissue culture of all members of the spotted fever group, with the exception of the rickettsiæ of *fièvre boutonneuse*. Growth of our tick typhus strains within the nucleus in tissue culture provides, therefore, support for the evidence for tick transmission of the disease, presented by Andrew *et alii*.

Summary.

1. Strains of rickettsiæ isolated from patients suffering from murine typhus and North Queensland tick typhus have been studied by a number of laboratory techniques.

2. In culture in the yolk sac of the chick embryo, the tick typhus strains caused earlier death of the embryo and showed less abundant growth than the murine strains.

3. Similar general features of infection in the guinea-pig were shown by the two types.

4. In guinea-pigs, the tick typhus strains conferred a partial immunity to the murine strains, and *vice versa*.

5. A difference in pathogenicity for the white rat was observed. Persistence in the brain of the rat of the murine strains, but not of the tick typhus strains, was demonstrated.

6. Intranuclear growth was observed in tissue culture of the tick typhus strains.

7. Samples of serum from patients with North Queensland tick typhus gave specific complement fixation with an antigen prepared from one of the tick typhus strains. The murine and tick typhus strains were shown to be serologically distinct.

Acknowledgements.

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NORTH QUEENSLAND TICK TYPHUS: STUDIES OF THE ÆTIOLOGICAL AGENT AND ITS RELATION TO OTHER RICKETTSIAL DISEASES.

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A RICKETTSIAL DISEASE apparently transmitted by ticks has been recently recognized in Australia by Andrew, Bonnin, and Williams.(1) These authors presented clinical and epidemiological evidence which appeared to differentiate the infection from the common rickettsial diseases previously known to exist in the area. Furthermore, they were able to recover a rickettsial agent from two of their patients with the malady which has now been designated "North Queensland tick typhus". Early in the investigation of this disease sera from a number of the patients were transmitted to the Army Medical School by Dr. F. M. Burnet for specific rickettsial diagnostic tests. The results of these studies, which are summarized in Table II of the accompanying paper by Andrew, Bonnin, and Williams,(1) showed that the sera from the patients in question contained no demonstrable antibodies of epidemic or murine typhus, *fièvre boutonneuse*, South African tick bite fever, or Rocky Mountain spotted fever. Subsequently, the PHS strain of Rickettsia, which had been isolated from one of the patients,(2) was submitted to us by Major A. V. Jackson.(3) The present report deals principally with immunological studies on the PHS strain and presents data which indicate that his agent differs from a number of other rickettsiæ which are pathogenic for man.

Pathogenicity of the Agent of North Queensland Tick Typhus.

The PHS strain of the organism of North Queensland tick typhus was received as lyophilized yolk sac material. During the investigation of this agent a number of observations were made which are in close agreement with those of the Australian workers.(1)(2) A detailed discussion of these observations is unnecessary; however, sufficient data will be presented to confirm that given in the accompanying report.(1)

Guinea-Pigs.

The experimental disease in guinea-pigs was initiated with infected yolk sac material. Subsequently it was maintained by serial passage of a suspension of infected guinea-pig tissue. Such passage material was obtained from animals sacrificed within the first day or so after scrotal swelling had appeared, and was prepared by shaking both testicles with the attached tunica in a flask with glass beads and 20 cubic centimetres of physiological saline solution. Male guinea-pigs, weighing 400 to 500 grammes, were inoculated intraperitoneally with one cubic centimetre of such a suspension. The animals were observed daily and temperatures above 103·9° F. were regarded as indicating fever. The characteristic disease consisted of fever, which usually began about the fourth day and persisted for about three days at a level of 104° to 105° F. Scrotal swelling, which was similar in degree to that generally encountered in guinea-pigs infected with murine typhus, usually appeared simultaneously with the pyrexia, but occasionally was noted before fever occurred or some-

[1] Member, United States of America Typhus Commission.

what later. Scrotal swelling usually subsided at the time the temperature returned to normal range, but occasionally persisted for several days beyond this point. Not all guinea-pigs receiving infectious material responded with fever or scrotal swelling (see control group in Table II); whether these represented inapparent infections or missed infections[3] was not determined. In our experience the disease in guinea-pigs never resulted in death from the infection. Guinea-pigs sacrificed at the height of the disease showed inflammatory changes with an occasional exudate involving the *tunica vaginalis* and testis. The spleen was sometimes enlarged and was covered with a moderate exudate. Impression smears of the *tunica vaginalis* stained by Macchiavello's technique showed a number of large endothelial cells with rickettsial organisms scattered throughout the cytoplasm. Rickettsiæ were not observed in the intranuclear position in endothelial cells found in such smears.

Mice.

The PHS strain was originally recovered from mice maintained on a vitamin-deficient diet, which were injected with blood of the acutely ill patient.[1] Further observations on the susceptibility of mice were not recorded by the Australian workers.[1][3] In our experience white mice injected intraperitoneally with 0·5 cubic centimetre amounts of infectious guinea-pig tunica washings showed no clinical signs of disease. In contrast, all of the ten mice injected intraperitoneally with agar tissue culture material rich in PHS rickettsiæ sickened in four or five days; four died between the sixth and eighth days, but no rickettsiæ were demonstrable in stained smears of their spleens, and the remaining animals recovered. Portions of the same suspension failed to induce obvious illness in ten other mice injected by the subcutaneous route. Furthermore, a suspension of splenic tissue of mice moribund following intraperitoneal infection with the tissue culture material failed to induce an apparent disease in normal mice. On another occasion five mice were injected intraperitoneally with two cubic centimetres of a 10% suspension of the twenty-second yolk sac passage of the PHS strain; one died on the tenth day.

Mice that recovered from scrub typhus infection are solidly immune to reinfection with homologous or heterologous strains of *Rickettsia orientalis*.[4][3] Those mice which survived injection of PHS tissue culture suspension were subsequently challenged intraperitoneally with 100 minimum lethal doses of *Rickettsia orientalis* in the form of frozen splenic suspension from mice infected with the Seerangayee strain.[6] These mice did not resist the challenge inoculation. Four other mice, which had survived injection with the twenty-second yolk sac passage material, subsequently succumbed when challenged intraperitoneally with 10 minimum lethal doses of *Rickettsia orientalis* of the Volner strain.[7]

Embryonated Eggs.

Growth of the rickettsiæ of North Queensland tick typhus was readily obtained in the yolk sac tissue of embryonated hen's eggs. Cultures were initiated with the original lyophilized material received from Australia, and were maintained by inoculation of 0·5 cubic centimetre of a 1 in 20 dilution of passage yolk sac tissue into the yolk sacs of six or seven day embryonated eggs. Inoculated eggs were incubated at 35·5° C. After the agent had become established, death of the embryo regularly occurred between the third and fourth days after inoculation. Rickettsia-like organisms were consistently observed in smears of infected yolk sac tissue stained by Macchiavello's method. The PHS strain has been carried through 86 yolk sac passages. Even after this prolonged cultivation, the growth of the agent under these conditions remained relatively poor; smears from yolk sac tissue rarely showed more than 40 organisms per field.

Agar Tissue Cultures.

The PHS strain grew much better on agar tissue culture than in the yolk sac. For these studies the PHS organism was cultivated by the modified agar tissue method originally used for the growth of *Rickettsia prowazeki*[8] and now widely used in this laboratory. Each set of agar tissue cultures was initiated with infected yolk sac material. The agar surface of each Kolle flask was inoculated with two cubic centimetres of a mixture containing one part of infectious suspension of yolk sac (1 in 20 dilution) and two parts of a brei of 10-day chick embryo cells. The mixture of infectious suspension and normal cells was stored at ice-box temperature (4° C.) for a half-hour prior to inoculation of the flasks. Inoculated flasks were incubated at 35·5° C. for seven days.

Intact cells with numerous rickettsiæ in the intranuclear position were observed occasionally in smears prepared from the agar tissue cultures of the PHS strain, but occurred less frequently than in similar cultures of the agent of Rocky Mountain spotted fever. It will be recalled that Pinkerton and Hass[9] have emphasized the intranuclear distribution of rickettsiæ of Rocky Mountain spotted fever in contrast to the intracytoplasmic occurrence of typhus organisms. Observations in this laboratory[10] have indicated that agar tissue cultures are particularly well suited for the demonstration of the intranuclear occurrence of rickettsiæ. Such a distribution has been found not only in Rocky Mountain spotted fever, but also in Brazilian spotted fever, Colombian spotted fever, Mexican spotted fever, South African tick bite fever, and *fièvre boutonneuse*, but has not been encountered in cultures of epidemic, murine or scrub typhus, or of "Q" fever.

Serological Specificity of North Queensland Tick Typhus Antigens.

Complement-fixing antigens were successfully prepared from agar tissue cultures in which the PHS strain had been grown. The antigens were prepared as follows:

Culture flasks containing tissue rich in rickettsiæ and free of contamination were selected by microscopic examination. The condensation fluid which accumulates in the flask during incubation was removed and discarded. Then five millilitres of diluent, consisting of physiological saline solution containing 1/75 molar citrophosphate buffer solution (pH 7·0) and 0·2% formaldehyde (United States Pharmacopœia) and 0·01% "Merthiolate", were added to each flask. The cells were scraped off and harvested. The material from several flasks was added to a bottle containing glass beads and shaken in a machine for fifteen minutes. The supernatant fluid obtained after spinning in a horizontal centrifuge at 1,000 revolutions per minute for fifteen minutes was removed and saved, after which fifty millilitres of the diluent were added. The resultant suspension was centrifuged at 1,000 revolutions per minute for ten minutes and the supernatant fluid was pooled with the first supernatant fluid. The sediment was discarded. The pooled suspension was stored at 4° C. for six days in order to render the rickettsiæ non-infectious, and was then extracted with an equal volume of ethyl ether. The aqueous phase was removed promptly and reextracted with half a volume of ether. The rickettsiæ and the aqueous phase were sedimented by centrifugation in an angle machine run in the cold at 4,000 revolutions per minute for one and a half hours. The sediment was resuspended in 200 millilitres of diluent and again centrifuged in the angle machine. This twice-washed sediment, rich in rickettsiæ, was resuspended finally in fifteen millilitres of physiological saline solution and centrifuged at low speed to remove aggregated particles.

Such suspensions of washed rickettsiæ were employed as antigens in tests performed by the complement fixation technique regularly used in this laboratory.[11][12][13][14] In brief, this method employed two units of antigen, two full units of complement and serial dilutions of serum to be tested. After incubation at 4° C. overnight the hæmolytic system was added; each tube received 0·25 cubic centimetre of a 3% suspension of washed erythrocytes and 0·25 cubic centimetre of saline solution containing three units of amboceptor. Tests were read in the usual manner after incubation at 37° C. for half an hour.

The results of a series of complement fixation tests in which PHS antigen was used at a dilution of 1/2 with sera from a group of PHS convalescent guinea-pigs are summarized in Table I; these animals had been infected

TABLE Ia.
Specificity of Complement Fixation Reaction in North Queensland Tick Typhus.

NQTT[1]-Immune Guinea-pig Number.	Complement-Fixing Antigens.							
	NQTT.	Epidemic Typhus.	Murine Typhus.	RMSF.[1]	SATB.[1]	FB.[1]	"Q" Fever.	Normal Yolk Sac.
1887	1/320	0	0	0	0	0	0	0
1888	1/80	0	0	0	0	0	0	0
1889	1/80	0	0	0	0	0	0	0
1890	1/80	0	0	0	0	0	0	0
1891	1/40	0	0	0	0	0	0	0
1892	1/80	0	0	0	0	0	0	0
1893	1/80	0	0	0	0	0	0	0
1894	1/80	0	0	0	0	0	0	0
1895	1/40	0	0	0	0	0	0	0
1896	1/160	0	0	0	0	0	0	0

[1] "NQTT" = North Queensland tick typhus; "SATB" = South African tick bite fever; "RMSF" = Rocky Mountain spotted fever; "FB" = *fièvre boutonneuse.*

TABLE Ib.
Specificity of Complement Fixation Reaction in North Queensland Tick Typhus.

Type of Serum.	NQTT[1] Antigen.	Homologous Antigen.
Epidemic typhus guinea-pig serum ..	0	1/320
Murine typhus guinea-pig serum	0	1/160
SATB[1] guinea-pig serum	0	1/160
FB[1] guinea-pig serum	0	1/80
RMSF[1] guinea-pig serum	0	1/320
Normal guinea-pig serum	0	

[1] "NQTT" = North Queensland tick typhus; "SATB" = South African tick bite fever; "RMSF" = Rocky Mountain spotted fever; "FB" = *fièvre boutonneuse.*

with guinea-pig passage material. It is apparent that the antibody titres of sera of the immune pigs were from 1/40 to 1/320 when tested with the PHS antigen. These same sera, which were thus shown to react with PHS antigen, were subsequently proved to give negative results with specific complement-fixing antigens of epidemic and murine typhus, Rocky Mountain spotted fever, South African tick bite fever, *fièvre boutonneuse* and "Q" fever (Table I). Rickettsial antigens used in these tests had been prepared and standardized by methods already described from this laboratory.[11][12][13][14] The PHS antigen, when used in the same dilution which gave positive results with the PHS-immune sera, failed to react with known positive sera of guinea-pigs convalescent from epidemic typhus, murine typhus, Rocky Mountain spotted fever, South African tick bite fever and *fièvre boutonneuse* (Table I).

It is evident from the serological data presented that guinea-pigs recovered from infection with the PHS strain develop specific complement-fixing antibodies which react with antigens prepared from the homologous rickettsiæ but not with antigens made from six other rickettsial agents. Furthermore, rickettsial antigens prepared from the PHS organism do not react with known positive sera against these six heterologous rickettsiæ. Thus, one may conclude, on the basis of these serological tests, that the rickettsiæ of North Queensland tick typhus are unrelated to the other rickettsial agents mentioned.

TABLE II.
Queensland Tick Typhus Convalescent Guinea-pigs Challenged with Agents of Murine Typhus and South African Tick Bite Fever.

Immune Guinea-pigs.								Control Guinea-pigs.			
Guinea-pig Number.	Complement Fixaton.				Challenge Infection.	Fever. (Days.)	S.R.[1] (Days.)	Guinea-pig Number.	Infection.	Fever. (Days.)	S.R. (Days.)
	Epi.[1]	Mur.[1]	SATB.[1]	NQTT.[1]							
1617	0	0	0		SATB	1	0	1	SATB	4	4
1618						1	0	2		4	3
1619	0	0	0	1/20		1	0	3		3	6
1620						0	0	4		3	5
1621	0	0	0	1/40		1	0	5		3	5
1622						1	0	6		3	5
1623	0	0	0	1/80		1	0	7		3	4
								8		3	3
								9		3	1
								10		2	5
1572	0	0	0		Murine	0	1	1	Murine	6	5
1624	0	0	0			1	0	2		4	4
1625	0	0	0	1/40		0	0	3		3	3
1628						1	0	4		3	3
1629	0	0	0	1/80		0	0	5		3	4
1630	0	0	0	1/40		0	0	6		3	5
1631						0	0	7		3	4
1632	0	0	0	1/80		1	1	8		1	4
								9		1	2
								10		1	4
1633	0	0	0		NQTT	0	0	1	NQTT	5	7
1636	0	0	0			0	0	2		4	4
1637	0	0	0			0	0	3		3	6
1638	0	0	0			0	0	4		3	6
1639	0	0	0			0	0	5		3	4
1640	0	0	0			0	0	6		2	4
1643						0	0	7		2	2
1644	0	0	0			0	0	8		2	6
								9		0	0
								10		0	0

[1] "Epi" = epidemic typhus; "Mur" = murine typhus; "SATB" = South African tick bite fever; "NQTT" = North Queensland tick typhus; "SR" = scrotal reaction.

TABLE III.

South African Tick Bite Fever Convalescent Guinea-pigs Challenged with Agents of Murine Typhus and Queensland Tick Typhus.

Guinea-pig Number.	Complement Fixation.				Fever. (Days.)	SR.[1] (Days.)
	Epi.[1]	Mur.[1]	SATB.[1]	NQTT.[1]		
Challenge Infection: SATB.						
1647	0	0	1/80		0	0
1648	0	0	1/10		0	0
1650	0	0	1/80		0	0
1651	0	0	1/40		0	0
1652	0	0	1/40		0	0
1653	0	0	1/160		1	0
1654	0	0	1/40		0	0
1656	0	0	1/40		0	0
1657	0	0	1/80		0	0
Challenge Infection: Murine.						
1658	0	0	1/80		0	0
1659	0	0	1/40		0	0
1660	0	0	1/40		0	0
1661	0	0	1/40		0	0
1662	0	0	1/40		0	0
1663	0	0	0		1	0
1664	0	0	1/160		0	0
1666	0	0	1/20		1	0
1667	0	0	1/40		0	0
Challenge Infection: NQTT.						
1577	0	0	0	0	6	2
1668	0	0	1/80		1	3
1669	0	0	1/10		0	2
1670	0	0	1/40	0	0	0
1671	0	0	1/40		1	3
1673	0	0	1/40		0	2
1674	0	0	1/40	0	1	5
1675	0	0	1/40	0	0	0

[1] "Epi" = epidemic typhus; "Mur" = murine typhus; "SATB" = South African tick bite fever; "NQTT" = North Queensland tick typhus; "SR" = scrotal reaction.

Cross-Immunity Tests in Guinea-Pigs with Agents of North Queensland Tick Typhus, South African Tick Bite Fever and Murine Typhus.

A series of cross-immunity experiments was performed, in which groups of guinea-pigs were initially infected with the PHS strain, the Wilmington strain of murine typhus, or a strain of South African tick bite fever, and subsequently challenged with the homologous and heterologous rickettsiæ. The results of these studies will be presented in some detail, since they demonstrate an apparent relationship between these agents which was not brought out in the specific complement fixation tests. The following procedure was used throughout the first series of tests.

Male guinea-pigs, weighing 400 to 500 grammes, were each injected intraperitoneally with 1·0 cubic centimetre of a suspension of tunica and testicular washings from guinea-pigs infected with one of the three strains of rickettsiæ. About two weeks after the guinea-pigs became afebrile, they were bled and the individual serum saved for complement-fixation tests. A few days later they were challenged intraperitoneally with 1·0 cubic centimetre amounts of fresh suspensions of guinea-pig washings containing homologous or heterologous rickettsiæ. At the same time, groups of normal guinea-pigs were injected with the challenge material. Since all immune animals in the experiment which were challenged with a given agent were inoculated with portions of the same suspension, one set of control animals sufficed for each agent. Animals were observed for a period of three weeks.

Detailed information on these cross-immunity experiments is presented in Tables II, III and IV, and a summary of the data is given in Table V. It is evident from the tables that guinea-pigs injected with each strain developed specific complement-fixing antibodies for the homologous agent, and that animals were solidly immune to challenge inoculation of the homologous rickettsiæ. It is also apparent that injection with each of the three strains induced considerable resistance to reinfection with the heterologous strains. Thus certain of the animals were solidly resistant to the heterologous organism, in that they remained afebrile and developed no scrotal swelling after challenge. Furthermore, those animals which did respond to the cross-challenge invariably developed a milder disease than the control animals (Tables II to IV). Even when all such mild responses, which are undoubtedly indicative of partial resistance on the part of the animal, are considered as positive "takes", and the observations are summarized as in Table V, it still remains obvious that some cross-resistance occurs.

Thus while complement fixation tests indicated complete specificity of the North Queensland tick typhus materials, animal tests showed some resistance to cross-infection with North Queensland tick typhus, South African tick bite fever and murine typhus. These findings are similar in certain respects to those encountered in typhus and spotted fever. For example, guinea-pigs convalescent from Rocky Mountain spotted fever are partially resistant to infection with murine or epidemic typhus and, conversely,

TABLE IV.

Murine Typhus Convalescent Guinea-pigs Challenged with Agents of South African Tick Bite Fever and Queensland Tick Typhus.

Guinea-pig Number.	Complement Fixation.				Fever. (Days.)	SR.[1] (Days.)
	Epi.[1]	Mur.[1]	SATB.[1]	NQTT.[1]		
Challenge Infection: SATB.						
1676	1/20	1/80	0		1	0
1677	1/80	1/320	0		1	0
1678	1/40	1/320	0		2	0
1679	1/160	1/320	0		1	0
1680	1/80	1/320	0		1	0
1681	1/80	1/640	0		1	0
1682	1/80	1/320	0		1	0
1684	1/80	1/640	0		1	0
1685	1/80	1/160	0		0	0
Challenge Infection: Murine.						
1686	1/80	1/320	0		0	0
1688	1/80	1/160	0		0	0
1689	1/20	1/160	0		0	0
1690	1/40	1/160	0		0	0
1691	1/40	1/320	0		0	0
1692	1/80	1/320	0		0	0
1693	1/80	1/320	0		0	0
1694	1/80	1/160	0		0	0
1696	1/40	1/320	0		0	0
Challenge Infection: NQTT.						
1697	1/40	1/160	0	0	1	5
1698	1/80	1/320	0		1	2
1699	1/40	1/160	0		0	4
1700	1/80	1/640	0		1	3
1701	1/20	1/80	0	0	0	5
1702	1/20	1/80	0	0	1	5
1703	1/80	1/320	0	0	0	0
1704	1/40	1/80	0		0	5
1705	1/80	1/320	0		1	4

[1] "Epi" = epidemic typhus; "Mur" = murine typhus; "SATB" = South African tick bite fever; "NQTT" = North Queensland tick typhus; "SR" = scrotal reaction.

TABLE V.

Summary of Cross-Immunity Experiments Discussed in Tables II, III and IV.[1]

Initial Infection.	Challenge Infection.		
	NQTT.[2]	SATB.[2]	Murine.[2]
NQTT	0/8	6/7	4/8
SATB	6/8	1/9	2/9
Murine	7/8	8/9	0/9
None (controls)	8/10	10/10	10/10

[1] All animals developing any febrile or scrotal reaction were counted as giving positive findings. The numerator indicates the number of "positive" animals and the denominator indicates the number of animals in the group.

[2] "NQTT" = North Queensland tick typhus; "SATB" = South African tick bite fever; "Murine" = murine typhus.

typhus-immune guinea-pigs are resistant to Rocky Mountain spotted fever.[15][16] Although specific complement fixation tests show no relationship between spotted fever and typhus,[17] nevertheless, sera from subjects with spotted fever do contain agglutinating[15][17] and antitoxic[17] antibodies which react with typhus materials. It has been concluded that data obtained by such serological and cross-challenge experiments are sufficient to establish an immunological relationship between typhus and spotted fever. Our results in cross-challenge tests may indicate common immunological properties in the agents North Queensland tick typhus, South African tick bite fever and murine typhus. On the other hand, the partial resistance to heterologous organisms displayed by animals recently convalescent from one agent may be dependent upon other factors having to do with acquired cellular resistance. Our findings seemed unrelated to the ordinary interference phenomenon[18][19] elicited by a number of combinations of animal viruses because of the relatively long time interval between initial and subsequent injections. However, certain observations[20] on "acquired cellular resistance" of brain tissue to infection with immunologically distinct neurotropic viruses may present certain similarities to ours. Thus guinea-pigs recovered from an abortive infection with western equine encephalomyelitis virus were resistant for several weeks to the effects of inoculation by the same route of the viruses of eastern equine encephalomyelitis and vesicular stomatitis. Finally, damaged and regenerating cells have been shown to possess non-specific resistance to toxic and infectious agents.[21][22]

In order to obtain additional information bearing on this question of resistance to heterologous strains, another cross-challenge experiment was performed.

Eight guinea-pigs immune to North Queensland tick typhus, which had been initially infected fifty days previously, and four that had been infected eight months before, were separated into two comparable groups, and these as well as normal animals were challenged with a fresh suspensions of infectious North Queensland tick typhus or South African tick bite fever material. The results of this experiment are summarized in Table VI. It is apparent from the data presented that North Queensland tick typhus animals were solidly immune to reinfection with the homologous agent after fifty days and after eight months. Furthermore, such animals show no resistance to infection of the agent of South African tick bite fever at eight months, but still possess considerable resistance to the heterologous organism at fifty days. The available data are insufficient to decide how much of the cross-resistance observed in animals within the first fifty days after primary infection was dependent upon specific immunogenical factors and how much on non-specific effects. The data do, however, emphasize the need for consideration of the time interval in experiments dealing with cross-immunity studies in rickettsial diseases.

TABLE VI.

North Queensland Tick Typhus Convalescent Guinea-pigs Challenged after Different Time Intervals with Agents of North Queensland Tick Typhus and South African Tick Bite Fever.

TABLE VIA.

Guinea-pig Number.	NQTT[1] Immune.		Fever. (Days.)	Scrotal Reaction. (Days.)
	Interval.	Challenge.		
1892	50 days.	SATB[1]	1	2
1893			0	2
1895			0	2
1896			0	0
1888	50 days.	NQTT	0	0
1889			0	0
1890			0	0
1891			0	0
1378	8 months.	SATB	2	6
1379			1	6
1807	8 months.	NQTT	0	0
1808			0	0

TABLE VIB.
Normal Controls.

Guinea-pig Number.	Challenge Infection.	Fever. (Days.	Scrotal Reaction. (Days.)
1996	NQTT	2	6
1997		1	7
1998		1	6
1999		2	6
2000		3	5
2001	SATB	4	8
2002		3	6
2003		1	8
2004		2	7
2005		2	6

[1] "NQTT" = North Queensland tick typhus; "SATB" = South African tick bite fever.

Antibodies of North Queensland Tick Typhus in Sera of Patients.

Mention has been made of the results of complement fixation tests for antibodies against a number of the rickettsial agents which are performed in this laboratory on sera of patients from North Queensland. When a specific complement-fixing antigen for North Queensland tick typhus became available, a number of the sera listed in Table II of the paper by Andrew, Bonnin, and Williams[1] was retested with the new antigen. Consistently negative results were obtained. Negative results were also obtained with sera from other patients in the group; these were supplied to us in May, 1946, by the Australian workers. This was in contrast to the findings of Funder and Jackson,[3] who were able to demonstrate complement-fixing antibodies of North Queensland tick typhus in low titre in samples of serum from several of the same patients. While our results failed to provide proof of the ætiological relationship of the PHS strain of Rickettsia to the disease of the Queensland patients, those of the Australian workers appear to answer this important point. A number of factors may have contributed to the difference in results in the two laboratories—for example, the period in the disease when specimens were taken, deterioration of sera due to transportation and storage, and the use of different types of antigens.

Summary and Conclusions.

1. The PHS strain of Rickettsia recovered from a patient with North Queensland tick typhus is serologically unrelated to the agents of epidemic or murine typhus, Rocky Mountain spotted fever,[1] *fièvre boutonneuse*, South African tick bite fever, or "Q" fever. Sera from guinea-pigs recovered from infection with the PHS strain contain specific complement-fixing antibodies, which react with PHS antigen but not with antigens of the other rickettsial agents mentioned. Furthermore, sera which contain specific complement-fixing antibodies against these heterologous rickettsiæ fail to react with PHS antigen.

2. The disease induced in mice and guinea-pigs by the agent of North Queensland tick typhus differs from that ordinarily resulting from infection with strains of scrub typhus. In addition, mice convalescent from infection with the PHS strain are fully susceptible to challenge with *Rickettsia orientalis*.

3. The growth of organisms of the PHS strain within the nuclei of cells in agar tissue cultures resembles that of agents of the spotted fever group.

4. Guinea-pigs recently convalescent from North Queensland tick typhus, from South African tick bite fever or from murine typhus are solidly immune to reinfection with the homologous agent, and display considerable resistance to infection with the heterologous strains. The question is raised whether this resistance to heterologous agents is evidence of specific immunity or of an acquired cellular resistance dependent upon other factors. Certain evidence

[1] Since Brazilian spotted fever and Mexican spotted fever are antigenically identical with Rocky Mountain spotted fever, it may be concluded that these rickettsiæ are likewise unrelated serologically to the PHS strain.[23]

is presented which indicates that resistance to the homologous agent persists for a long period of time, whereas resistance to the heterologous agent fades out after a number of months. The importance of the time element in cross-immunity tests with rickettsial agents in guinea-pigs is emphasized.

5. The ætiological agent of North Queensland tick typhus is different from a number of the well-identified rickettsial agents and may well be a hitherto undescribed Rickettsia.

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ALCOHOL.[1]

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THIS is a paper on the sociological aspects of alcoholism. I shall not touch on the medical side of the individual case. Its objective is to answer or at least to present material for the consideration of two questions: (*a*) Is there really a major problem requiring further attention from citizens? (*b*) Does that problem concern us as doctors?

The first is dealt with in the following discussion; the second is more difficult and is best answered for the moment by reference to the existence of the Sociological Medicine Group of the Branch which I represent tonight, composed as it is of medical men who believe that efficient study of the diseased individual requires also a study of the various community factors which affect him, and by the fact that the New South Wales Branch has formed such a group and has accepted this subject of alcoholism for tonight.

How I Came to be Reading This Paper.

The immediate origin lies in the appearance of the following letter in THE MEDICAL JOURNAL OF AUSTRALIA, January 15, 1944.

THE LIQUOR REFORM SOCIETY.

The following statement is published at the request of the Council of the Queensland Branch of the British Medical Association.

Since alcoholism is injurious to the health and welfare of our people, the Council of the Queensland Branch of the British Medical Association considers that it is the duty of the medical profession to play an active part in controlling this great social evil.

The Liquor Reform Society, which has been formed in Queensland by leading citizens representing all sections of the community, is advocating certain practical objectives for reform which the Council, after careful consideration, has decided to support.

These measures, while not limiting unduly the freedom of the individual, will, if adopted, exercise sufficient control over the manufacture and distribution of alcohol so that it will no longer be a menace to public health and dignity.

The measures advocated are as follows: (i) That the liquor trade should be controlled in the interests of the public by a Federal Commission responsible to parliament. (ii) That the alcoholic content of beer be reduced to an amount not greater than 5% proof spirit. (iii) That all spirituous liquors and fortified wines be rationed on a plan similar to that in Sweden. (iv) That the closed bar system be eliminated. (v) That an educational campaign be instituted to demonstrate the evil, social and physical, effects of alcohol.

It so fired me with enthusiasm and admiration that a British Medical Association Branch should show such initiative that I expressed my feelings in a letter to the journal as follows:

LIQUOR REFORM.

SIR: I think that the decision of the Queensland Branch of the British Medical Association to openly support liquor reform—as published in THE MEDICAL JOURNAL OF AUSTRALIA of January 15—is the most wonderful thing I have seen in the pages of the journal.

[1] Read at a meeting of the New South Wales Branch of the British Medical Association on June 27, 1946.

May I be permitted to advocate that all local associations in other States take the matter up and press it upon their councils for similar action?

Further than that, this action but points the way to action on other fronts whereby doctors generally, acting collectively through their association, the British Medical Association, will see it as their duty to take a larger and larger part in all reforms which bear directly or indirectly upon the health and welfare of the community.

Yours, etc.,

February 10, 1944.

I very soon received a letter from the Liquor Reform Society suggesting that I help to form a similar society in New South Wales. So, after discussions with various medical men, I thought it most suitable to sell the idea to the Sociological Medicine Group. That group said "good", put up the subject for Branch discussions and invited me—for my sins—to read the paper. Here, then, is a paper, and it is hoped that it will represent a forward step.

At once I must emphasize that my case is for reform, not prohibition, and it is not desired that the moderate drinker be deprived of his simple drink.

The Facts.

Now I know many of you are saying: ". . . What does McKellar know about alcohol?" Well, prior to reading up a few things for this paper, I knew very little, but I know the pictures which everyone knows: The "drunk"—abusive, smelling, dishevelled, vomiting. The "pub"—a place of secret drinking and the six o'clock guzzle. The alcoholic at hospital—filthy language, clothes and behaviour; blood, vomit, smell and general nuisance—our young nurses obliged to look after them, our women and children patients to see and hear them, and as like as not, the treatment of other patients impeded.

After preparing the paper I have mainly a better understanding of the size of the subject. However, I believe I have managed to marshal some interesting figures and opinions (always with references to their source, avoiding the too-frequent habit of expressing mere opinions which cannot be substantiated, and as far as possible of local origin or locally applicable).

Further, I want to present a judicial review and to invite opinions on both sides of the question. For example, my chemist father listened to me at home, smiled, and returned with his "Martindale", Volume I, and a quotation from Sir James Barr: ". . . The murderers and cut-throats in Ireland and Russia were mostly teetotallers. . . ."

Similarly, in a "Symposium on Alcohol", THE MEDICAL JOURNAL OF AUSTRALIA, September 15, 1945, we have Dr. Guy Springthorpe: ". . . Crimes and other social misdemeanours might be committed by persons 'under the influence', but a great many more nasty actions were perpetrated by the stone cold sober. . . ."

Also the Medical Research Council Committee's booklet on alcohol, third edition, page 143, footnote, quotes from figures of Colonel Harrison: ". . . of 1,256 cases of V.D., 24% were total abstainers. . . ."

Perhaps much more on these lines can be adduced—it does not sound much like a case against alcoholism—but I invite more and ask them to be placed against those that will follow.

General.

I must omit some interesting physiology which might have provided a useful background, but cannot refrain from touching on two subjects of common interest, namely, alcohol as a food, and blood alcohol figures.

I quote from "Starling's Physiology", 1945: ". . . Alcohol in this way can act as a food and supply up to 40% of the daily calories, provided it is taken in small doses, often repeated, so as not to result in there being a high alcohol content of the blood. . . ." Though Best and Taylor, on the question of whether alcohol can furnish energy for muscular work, state: ". . . the evidence has been conflicting. . . ."

On blood alcohol figures, Starling states that 0·15% usually means mild intoxication; 0·25% usually means definite drunkenness; less than 0·1% may poison those unaccustomed to alcohol; over 0·2% may have little effect on some regular drinkers. It is interesting that, at least up to 1938, "it was the law in Sweden ("Report of Temperance Convention", 1930, page 29) that in all cases of motor accidents, the amount of alcohol in the blood of those concerned is to be estimated. For the purpose, the little glass tubes required are kept in all police stations, the finger is pricked, the little tubes are filled and sealed . . ."

Now as to whether moderate alcohol consumption affects the span of life, the same booklet considers large-scale insurance statistics and concludes there is no case against moderate drinking. The effects of excessive drinking will, I think, be generally conceded and need not be considered.

However, the following quotations in a booklet issued by the Queensland Liquor Reform Society are of considerable interest. Mr. Ross, State Government Insurance Office, stated: ". . . In regard to life insurance, barmen and barmaids received a loading on account of liquor being taken which would affect their longevity. . . ." And the executive of the Liquor Trades Union stated: ". . . Health statistics of the liquor trade show the highest death rate of any trade or calling and liquor workers' lives are shorter than in any other trade or calling. . . ."

The National Economy.

I quote from a preface, 1917, to the (British) booklet on alcohol: ". . . the total amount of money devoted to the purchase of alcohol by the inhabitants of these islands is . . . approximately equal to the total revenue of the State. . . ."

Britain's drink bill in 1935 (quoted by Lord Snowden) was £237,000,000, and it was estimated that in families where alcohol was drunk, an amount of about 15s. per week was so spent.

By 1945 (according to figures supplied to me by the Temperance Alliance) the drink bill was £685,000,000, and for every £1 spent on food, 9s. 8d. was spent on drink.

In Australia the drink bill to June 30, 1943, was £49,709,976 (Temperance Year Book), while the rise in excise revenue is especially interesting when one contemplates the chances of persuading a government wholeheartedly to support moderation (Table I).

TABLE I.
Excise Revenue (Australia).

Source of Revenue.	Year.			
	1929-30.	1939-40.	1941-42.	1942-43.
Beer	£6,000,000	£8,800,000	£14,300,000	£19,600,000
Spirits	£1,860,000	£1,870,000	£2,590,000	£3,840,000
Liquor licence fees	£1,000,000	£800,000	£1,000,000	£1,000,000

Enormous revenue from taxation on drink is admitted, but Lord Snowden quotes from a royal commission on licensing: "It is our belief that the benefits to be derived from the diminution of the present excessive expenditure on alcohol would progressively compensate for any loss on taxation yield from that source."

Family Economy and Poverty.

We have noted the British figures for the expenditure of a drinking family at 14s. to 15s. per week in 1935 and the later figures in 1945. On the question of whether alcohol causes poverty or poverty causes alcoholism I am obliged simply to quote opinions. For example, a booklet of the Liquor Reform Society quotes a Select British Committee on the Social and Economic Aspects of Alcohol which found that: "From 25% to 30% of the whole of the poverty in a typical working-class district was caused or was contributed by drink." Also from the Temperance Alliance: "A report in the legislature of the State of Massachusetts State Bureau of Statistics of Labour stated that 75% of the adult paupers in the State of Massachusetts were addicted to the use of liquor, and that 40% of the adult paupers attributed their pauperism to their own intemperate habits.

Home Life, Divorce, Children's Courts.

In regard to divorce, I refer only to two quotations. One is an extract from the Report of the Royal Commission on Divorce (Great Britain): "It seems probable from the evidence before us that habitual drunkenness produces as much, if not more, misery for the sober parties and the children of a marriage as any other in the list of grave causes." And in Australia, from a special article in *The Sunday Sun* of September 29, 1945: "This year, drink has been blamed in 70% of cases as the cause of divorce."

The Reverend Gordon Smee has kindly given me some figures from his private records as Church of England chaplain to the Children's Court, Sydney. A typical year showed: (i) That 48 per 1,000 cases were of "improper or incompetent guardianship". Liquor was a factor in 32 of these. (ii) That 113 per 1,000 were charged as "neglected young persons"; 78 of these were consuming liquor at the time of the charge. (iii) That 15 per 1,000 were charged straight out with drinking.

And finally, a topical reference—a recent *Sun* article headlines "Judge Cracks Down on Young Ruffians in Gangs". Judge Maxwell imposed sentences of up to five years on three youths for indecently assaulting a young girl under sixteen years. The article finishes: "The three youths . . . had all appeared in the Children's Court and they all drank."

Venereal Disease.

I am informed that 80% of army venereal disease patients were alcoholic at the time of their infection. Similarly, a Queensland Liquor Reform Society booklet stated that of 100 "drunks" taken at random in Brisbane, 48% were infected with venereal disease.

As to girls, almost all the girls picked up by the Vice Squad and subsequently found infected had been alcoholic, and, incidentally, about 30% of them had had abortions. Official figures of female venereal disease notifications are instructive (Table II).

TABLE II.

Year.	Total Number of Female Venereal Diseases Patients.	Percentage of Age 16 to 20 Years.	Percentage of Age 21 to 25 Years.
1941	842	18·3	24·1
1942	979	22·9	25·8
1943	1,255	27·9	27·9
1944	1,548	23·0	28·9
1945	985	20·4	28·3

Note that in 1943 the figure for girls of sixteen to twenty rose to equal that of the next group.

Crime.

I present official police figures for drunkenness and driving "under the influence" and some few authoritative opinions which may give those cause to think who doubt whether excessive alcohol drinking is a serious proposition.

Table III has been adopted from "Drink or Booze", 1943, page 16. Also this:

"Next after Norway, Australia has the unenviable position of heading the list of convictions for drunkenness. Australia's high figures of drunkenness are attained on beer, not spirits. England, moreover, with a beer consumption per head nearly 50% higher than Australia, has only one-eighth of the drunkenness; and the drunkenness figures are also low in France, whose inhabitants—man, woman and child—consume an average of over a gallon of wine per head per week."

The Temperance Convention of 1937 quotes J. Edgar Hoover, Director of the Federal Bureau of Investigation of the United States of America Department of Justice, June, 1936: ". . . the preceding three years . . . the most terrible period of criminal history in America. . . ." Note that these are practically the first three years after the repeal of prohibition.

TABLE III.

Year.	Crime.		Vehicle Registration.
	Drunkenness.	Driving under the Influence.	
1935	28,108	—	742,886
1936	31,090	—	
1937	29,452	589	895,023
1938	29,437	603	
1939	32,281	812	871,933
1940	34,565	778	
1941	34,585	543	750,833
1942	34,797	445	
1943	34,837	438	775,996
1944	34,487	544	
1945	43,892	704	—

The late Lord Ulverstone, Lord Chief Justice of England, stated that after forty years' experience at the bar and ten as judge, he knew as a fact that 90% of crime in Great Britain depended on intemperance.

Stipendiary Magistrate Farrington (*The Sun*, November 4, 1943) said: "Drink is the cause of 80% of police court offences."

National Defence.

I look first to the Official History of the Medical Services in the War of 1914-1918, Volume II, page 532: "For commissioned officers, if we except senescence, dependence on alcohol was probably the most frequent cause of failure to make good in the field. On Gallipoli, it was the direct cause of one major military tragedy. The fall of the 'pseudo-dipsomaniac', as he was then known, was early and complete: spirit soaking was laid bare by failure to stay the pace or rise to the occasion. . . . In lads of under 18, alcohol played havoc."

The drunken soldier is a cause of endless trouble and inefficiency. But the drunken officer is a danger that it is madness to overlook—a high position must only be a call for "many blasts to shake him".

Now, doctors in war not only treat the sick, they play a part in the military conduct of campaigns, and so in peace they should be a part of the national pattern so as to help organize for national prosperity.

Lloyd George said: "I can speak with some knowledge on this issue because I found that drink was rotting our national effort at equipment in deadly fashion. It indeed became a choice between alcohol and victory. Only by taking stern and revolutionary measures to restrict the use of liquor were we able to maintain the industrial efficiency which carried us through the terrible years to a final triumph. One of the results of our war-time legislation was to reduce the consumption of absolute alcohol by 50%. What was true in war is no less true in peace, although the threat to national safety is less clearly visible."

The Law, Politics.

The great danger is the contempt of the law which the market in alcohol teaches. For example, in New South Wales during 1925-1942, convictions for violation of the liquor laws (exclusive of drunkenness) ranged, *per annum*, from 3,000 to 4,600.

The late R. B. S. Hammond, at the Temperance Convention in 1937, said that there were four major problems throughout the world today and that drink played a dominant and evil part in every one of them: (*a*) motor accidents, (*b*) slums, (*c*) health, (*d*) politics. And of politics he said: "There is no more sinister and evil thing in politics than alcohol, and there is no solving the political problem until the liquor interest is removed."

One feels, too, that the liquor trade plays a great part in promoting contempt of the law, and reports of such in the daily Press are well known to you all. For example, the Melbourne *Herald* of July 20, 1942, states: "A greater shock could not have been administered to the moral sense of those in the community who have persisted in thinking that stories of the lawlessness of the liquor traffic have been exaggerated than the revelations made at the Leonski

trial of flagrant and open violation of the licensing laws. . . . The liquor trade has greater potentialities for evil than any other business. It is evident that with the toleration of authority these potentialities are being fully exploited for illicit gain."

Accidents.

The Road Safety Council of New South Wales has obliged me with the figures for accidents in which alcoholism was a factor. Those for 1945 are shown in Table IV.

TABLE IV.

Group.	Cases of Intoxication.	Total.	Percentage Alcoholic.
Number of accidents	439	5,071	8·7
Number of persons injured	521	6,272	8·3
Number of persons killed	31	408	7·6

The Plan for Reform.

I have in mind no immediate grand plan. However, we can take steps to develop a plan. Required firstly is recognition by the British Medical Association that it supports suitable principles. I suggest: (*a*) reform, not abolition; (*b*) initial medical leadership; (*c*) no church control. And it is desired to implement these by establishing a standing medical committee to collect data and evolve details of a plan. When this is done, other bodies can be approached with a view to cooperation and formation of a Liquor Reform Association of New South Wales.

Attention is drawn mainly to the following objectives of the Queensland Liquor Reform Society.

(*a*) *Control of Liquor Trade.*—". . . It is felt that such a potentially dangerous commodity as alcohol can no longer be left in the control of persons who make more profit the more alcohol is consumed. The trade should be controlled by some statutory body which has no monetary interest in the sale of alcohol, but which, on the contrary, does its best to reduce consumption."

(*b*) *Reduction of Spirit Content of Liquor.*—Reduction from 8% proof spirit in beer to 5% is advocated. (Proof spirit is 57% alcohol. Sydney bottled lager contains 8·6% spirit.)

Correspondence between the Queensland Liquor Reform Society and the Government on the question of reducing the strength of beer should be interesting to you. The following is an extract from a letter from the Prime Minister's Department, Canberra, February, 1945.

> . . . in regard to the question of reduction of the alcoholic content of beer, and to inform you that this matter is primarily one coming within the province of the various State governments. Investigations made by the Commonwealth, however, have shown that no appreciable reduction could be made in the present alcoholic content of Australian beer without materially altering the type of beer or endangering its keeping qualities. Owing to great distances over which bulk beer has to be transported, and climatic conditions to which it is subjected during such transportation, a considerable risk of financial loss and waste of raw materials, etc., would be incurred in reducing the present strength.

And here is a letter from the Liquor Reform Society to the Minister for Trade and Customs, March 6, 1945.

> My society must disagree, however, with your remarks of February 27, despite their scientific origin. I refer particularly to the statement that a reduction in alcoholic content is impracticable because of the long transport distances and high temperatures prevailing in Australia. According to what we believe to be competent and reliable information, the type of reduction we suggest has already been made in one or two Australian beers.
>
> As for keeping qualities, which the Commonwealth Analyst states depend on pasteurization and preservatives, we understand that Queensland beers today are already pasteurized, and furthermore, most of it is consumed soon after it is brewed.

(*c*) *Mode of Consumption.*—The four objectives are: community ownership of hotels, alcohol to be taken with food and with social amenities, the abolition of tied houses, the abolition of secret drinking in closed bars.

(*d*) *Educational Measures.*—The educational measures suggested are that moderation should be preached and that the public should be taught that alcoholism is anti-social.

Now, the Queensland Liquor Reform Society appears to be a very active body, but time does not permit me to go into much detail about it. I should like you, however, to note the impressive array of forces arrayed against alcoholism in its full-page list of affiliated bodies, including, for example, many unions, such as the Boilermakers' Union, the Federated Ironworkers' Union of Queensland, Federated Clerks' Union, Trades and Labour Council of Queensland, the Returned Sailors, Soldiers and Airmen's Imperial League, the Chamber of Commerce, the Australasian Trained Nurses' Association, women's associations and many other important bodies.

What do you say, for example, of the force which gets these bodies together—brothers in arms—in a *Courier-Mail* newspaper competition for suggestions of plans for liquor reform: the British Medical Association, the Trades and Labour Council, the Returned Sailors, Soldiers and Airmen's League, the National Council of Women, the Women's Auxiliary of the Trades and Labour Council. It all shows one need not fear overmuch the strength of the opponents.

One last shot in the battle, apropos of teaching that alcohol is anti-social—I personally want to see facilities provided at mental hospitals for the treatment of the injured alcoholic. For the public hospital it would be a pleasant change. For the alcoholic and the public it would be an educational measure "of the first water".

ALCOHOLISM.[1]

By S. J. MINOGUE, M.B., Ch.M., D.P.M.,
Medical Superintendent, Mental Hospital, Rydalmere, New South Wales.

VERY few can regard the question of alcoholism impartially. The moderate drinker condemns it only for its excesses; to the drunkard it is life itself; to most teetotallers it is an unmitigated curse. In all the controversies normal drinking, a social and moral problem, is confused with pathological drinking, essentially a psychiatric one.

To most people drinking is but a social habit, which they can abandon at will. Even hardened drinkers, for any sufficiently grave physical or psychological reason, can become teetotallers, even if it does mean some mental and physical suffering.

Tolerance to alcohol is still little understood. Both physical and psychological factors seem to enter into the question. One man can drink heavily for years without apparent ill-effects; another becomes drunk on one or two beers. Seasoned drinkers, when mentally or physically exhausted, or, *inter alia*, as a sequel to a head injury, may become easily drunk. Again most men in a good social position try, however unsuccessfully at times, to conceal their drunkenness; the uneducated labourer makes no attempt to do so.

The point at which drinking becomes pathological is as nebulous as most borderlines in psychiatry. Alcoholic excesses may be symptomatic of such diseases as manic-depressive pychosis and the neuroses, especially in returned soldiers with anxiety neurosis. Dipsomania or true inebriacy is here, rightly or wrongly, treated as a disease *per se*. It is so terrible in its manifestations and so disastrous in its consequences that it had brought untold misery to millions.

[1] Read at a meeting of the New South Wales Branch of the British Medical Association on June 27, 1946.

A true inebriate is hypersensitive, imaginative, hard-working and generally capable above the average, a fact attested by the number of brilliant statesmen, poets and scientists who died as drunkards. Their brilliancy made them too susceptible to the influence of alcohol, or it may be that most inebriates are hyperrealists and see too vividly the artificialities of the world around them for them to live in it in comfort. By his very temperament then the inebriate is different from his fellows and is not understood. Although usually a likeable fellow and an excellent mixer, his only friends are his drinking companions. He is lonely, self-centred, egotistical, thinking only of himself and erecting around himself a barrier of reserve that conceals his true thoughts from doctors, psychiatrists and clergymen. Indeed he takes a morbid delight in misleading anyone who tries to help or to cure him.

His selfishness increases with the years. Family, position and money exist only for the gratification of his own desires. Many inebriates have been ruined by the fact that they are only sons or have been waited on hand and foot by female relatives. A time comes when his selfish desires can no longer be gratified and he shows his resentment and self-pity by fighting a one-man battle with the world.

The arrogance and resentment shown by most inebriates conceal a timid nature, which is a prey to morbid fears and anxieties. Their timidity emphasizes their emotional immaturity, which manifests itself by emotional outbursts and childish actions. Drink helps them to overcome their fears and to meet others on an equal footing.

Most inebriates show from the beginning an inability to control their drinking. They mix their drinks indiscriminately and will keep on drinking whilst there is anything left to drink. They are dominated by the desire to drink as much as possible in the shortest possible time and are haunted by the fear that when they wake up they will have nothing to drink. Soon they learn to outwit their relatives by concealing bottles of liquor in diabolically cunning hiding places. As money becomes short they learn to pawn anything they can, no matter how great its sentimental or religious value, or to whom it belongs. They become expert in borrowing money from relative strangers, psychiatrists and clergymen.

The irresistible desire of the inebriate to get drink starts with his first drink, even after years of abstinence. The bout heralds itself by his increasing arrogance and by his confidence that he can control his drinking. He dresses himself carefully, fills his pockets with money and sets out. He may limit his drinking for a few weeks, but nevertheless the bout is inevitable. Knowing full well that he should not drink, he invents excuses to justify himself, his unhappy home life, business and numerous other worries. As one ex-inebriate puts it: "The excuse must be good enough to satisfy ourselves and others."

During the bout he becomes very tremulous, especially in the mornings, and he must drink to become steady enough to work, to sign cheques and to overcome his fears, apprehensions and suicidal impulses. His condition steadily deteriorates until he develops the inevitable attack of acute alcoholism in one or other of its many forms. Then follows the recovery with its dreadful fears and apprehensions that so frequently determine him to suicide.

Some inebriates drink continuously and become demented. Others have sprees with months or years between the attacks. Some may control their drinking for years and may be able to carry on their work. But as the inebriate is born, he is one from his first drink. A man who had his first drink when forty-seven died of chronic alcoholism five years later. Many returned soldier inebriates would probably never have touched alcohol had it not been for their army experiences.

Wealthy inebriates protect themselves over the years in private hospitals. Wage-earners gradually descend in the social scale, and when destitute drink cheap wine and methylated spirits, a sign of poverty more often than of depraved taste. In "metho camps" around Sydney are to be found men who were once world famous in scientific, learned and sporting circles. In the same camps have died some of the most famous sons of Australia "with none so poor as to do them reverence".

Treatment.

Inebriates in Australia are regarded as criminals, who must recover from their bouts in prisons, in reception houses or as prisoners in mental hospitals under *The Inebriates Act*. Others make a painful recovery from their bouts in "metho camps" or doss-houses. Unless the patient is wealthy, hospitals are most reluctant to treat them. The result has been that there exists a bitter hostility between inebriates and those who must care for them. Whilst this hostility has been mainly due to the actions and the abuse of the patients themselves, it has destroyed the mutual trust and confidence that should exist between doctors and patients. But so ingrained in us is this hostility that if one sets out to study alcoholics, it is far better to forget previous experiences and to learn the subject anew.

Treatment depends on accurate diagnosis, a point little appreciated in Australia. The mere talking over of difficulties to a trusted confidant may in itself be sufficient to cure many alcoholics. If the drinking is symptomatic of a psychiatric disease, the treatment is that of the causative disease. An alcoholic who is mentally or physically exhausted should have a prolonged rest before any psychological treatment is undertaken. Similarly some men can be kept sober by signing the pledge, or by the fear of the sack or court proceedings if they continue to drink.

The treatment of alcoholism is then peculiarly that of the patient and not of his disease. This requires a wide knowledge of psychiatry and character types, as well as a first-hand knowledge of inebriates, not only in hospitals and consulting rooms, but in hotels, prisons, doss-houses, "metho camps" and in meeting ex-inebriates socially. But as this point of view is so new, the study of alcoholism in Australia is a virginal field. But he who explores the field must be fully prepared to put up with criticism and amused cynicism from colleagues, suspicion from members of the public and the patients themselves, and in the beginning the very great discouragement of poor clinical results, the fruits of ignorance, inexperience and over-enthusiasm.

Before any treatment can be instituted the inebriate must be "dried out". The following treatment gives excellent results and ignores the controversies whether alcohol is essential or harmful in the treatment of acute alcoholism. The first essential is to get him to sleep. Two drachms of paraldehyde with an ounce of water and an ounce of brandy are given at once. This draught may be repeated in four hours. On awakening, he is given an ounce of brandy followed in two hours by a dose of the mixture.

℞
Potassii Bromidii
Chloral Hydratis ana grains 10
Tincturæ Opii
Extractii Glycyrrhizæ Liquidi ana minims 10
Aquæ ad half ounce

The alternation of brandy and mixture every two hours is followed for two days. Their administration requires a specially trained and intelligent nursing staff, preferably one with psychiatric experience. The mixture or brandy will then be given or withheld according to the needs of the patient and not by rule of thumb. The patient will be coaxed to take food, and if necessary he will be given an enema or aperients. The paraldehyde may be repeated on the second night. On the third day the mixture and the brandy will be given three times each; on the fourth day twice; on the fifth and following days the mixture only at night.

On about the third day he is apparently much better. He is still, however, dominated by his desire for drink and will use every trick he can to get it. An astute and experienced guard is here essential. The desire passes off about the fifth day and the patient should be quite well within a week.

The hopelessness of trying to keep these patients sober induced me to investigate the methods of Alcoholics Anonymous. This society was started in 1934 by an American business man, who realized that if he was to survive he had to give up drinking. With the help of an inebriate doctor he formed the society, which now has 24,000 members. A branch was formed in Sydney eighteen months ago, and it is on the experiences of that branch that this paper has been largely based.

Alcoholics Anonymous bases its principles on religion of the broadest possible type, medicine, psychiatry, and on the ex-inebriate's keeping himself sober by trying to rescue other inebriates. The society claims a recovery rate of 75% in those genuinely anxious to get well, 50% at once, 25% after one or more relapses. Already in Sydney inebriates who had been regarded as hopeless by experienced psychiatrists have remained sober and self-supporting for many months.

Unless an inebriate has a genuine desire to get well, nothing can be done for him. We still cannot determine in many cases whether the patient is sincere or otherwise when he says he wants to give up drinking. If we could we should save ourselves many difficulties, disappointments, much wasted effort and bitter criticism. For it is a fact that many inebriates through long years of practice are using reception houses, mental hospitals, gaols, State and denominational hospitals and institutions as safe retreats when they are drunk or in trouble. Alcoholics Anonymous offered them a new retreat, of which they freely availed themselves, even to the extent of keeping sober for many months. When this retreat failed them they became bitter and resentful critics of the society.

Those who have remained sober have become sociable, discussing themselves freely with others. They have lost their arrogance and spend their spare time helping other inebriates. But those who have remained arrogant and confident that they could control their drinking, no matter how long they have been sober, will not remain so. It usually takes two or more relapses to teach them that they cannot drink. Too many inebriates are over-protected by relatives, doctors, hospitals and clergymen. Unless such men "hit the rock bottom" when all their excuses for drinking fall to the ground, they will not improve. It is much better to withdraw help and protection from them, to precipitate a crisis in their affairs, thus compelling them to reach bedrock. Then, and then only, will stark reality compel them to reform their ways or perish.

They are not interested in Alcoholics Anonymous when they are drinking or in the self-confident stage between the bouts. All that can be done is to tell them that if they want help at any time, it will be given, but it will not be forced on them. The request for help is usually made in the depressed stage following a bout. It is usually a sign that they have reached the depths and realize that of themselves they are powerless. Once the request has been made their chances of keeping sober are good.

Bitter experience teaches that unless an inebriate is prepared to stand on his own feet, he will not remain sober.

Only a proportion of inebriates are suitable for Alcoholics Anonymous methods; the remainder must be treated on psychiatric lines. But as inebriates flock to Alcoholics Anonymous for help, there must exist, as in America, the closest cooperation between doctors and Alcoholics Anonymous members.

Whilst it is true that many alcoholics are kept sober by the conditioned reflex treatment, psychoanalysis, hypnosis and such like, the success of temperance advocates, such as General Booth, Father Matthew and Archdeacon Hammond, as well as the great success of Alcoholics Anonymous in reforming inebriates, emphasizes the failure of medical and psychiatric procedures in the same work. We must sink our pride and prejudices and either copy their methods or ally ourselves with them. And when we do we shall realize that the question of alcoholism is not solely a medical prerogative, but is one that vitally concerns the police, the courts, the churches, and all bodies interested in social welfare.

It is obvious that, if the question is to be treated scientifically, clinics for the diagnosis and treatment of patients are imperatively necessary. These clinics, one of which has already been started in Sydney, show the magnitude of the problem and demonstrate that there are many alcoholics who sincerely desire to give up drinking. Similarly they show that many returned soldiers, some of them with high military decorations, cannot be rehabilitated until they are cured of their alcoholism. Above all they prove that many brilliant men, whose talents Australia can ill afford to lose, are living as drunken derelicts.

The field of alcoholism is a vast one waiting to be explored. When it has been explored the reward of seeing drunken derelicts turned into happy, self-supporting citizens outweighs all the many trials, worries and disappointments that are being constantly met with. On the other hand, when, in spite of all your efforts, you see worthy men and women deteriorating before your eyes, you will then realize your limitations and begin to recognize, probably for the first time, that the study of alcoholism is so vast and so complex that its mastery is probably beyond the lifetime of any one individual.

REPRODUCTIONS OF RADIOGRAPHS BY SOLARIZATION.

By D. G. MAITLAND,
Sydney.

THE purpose of this paper is to present to the members of the Australian and New Zealand Association of Radiologists and to others who may be interested a simple, rapid and effective method of reproducing full-sized radiographs on X-ray film. If so desired, essential portions of large films can be reproduced by direct contact printing. The method is based upon the paper by G. H. Illingworth, which was read at the annual general meeting of the Faculty of Radiologists held at Leeds in 1945, and published in *The British Journal of Radiology* of February, 1946. Slight modification of his technique is suggested. The application of the method for clinical libraries, interstate exchange of X-ray films and teaching purposes will be self-evident. The standard dark-room equipment of any X-ray department is sufficient, with the addition of (i) a photographic printing frame or similar device, size 17 inches by fourteen inches, and (ii) a shallow dish of sufficient size to accommodate a 17-inch by 14-inch film reproduction; the dish is of use in reducing the copy film, but reduction is not always necessary.

Some photographic film emulsions are said to become solarized when they are subjected to prolonged exposure to light, and in consequence fail to become black when immersed in standard developer. It is fortunate that the emulsion of an X-ray film is ideal for solarization, though some types of emulsion solarize better than others.

Only for the purpose of explanation, the rough diagram in Figure I represents the degree of blackening of an X-ray film when exposed and when the exposure time is prolonged. A, B and C represent under-exposed, correctly exposed and over-exposed areas respectively; the steepness of the curve represents the rate of change of density, and this in consequence represents the degree of contrast obtained in the ordinary radiograph. At C the curve flattens and the photographic emulsion would be completely black if developed at this stage of exposure. Therefore, the change from A to C is from white to black.

As the time of exposure increases, very little change in blackness would be appreciated if the film was to be developed at any stage along this time of exposure (D). At the distal portion of D, however, a remarkable change occurs in the behaviour of the emulsion, and as the duration of exposure increases the degree of density of the film diminishes almost to zero. This is the portion of the curve marked "S", which represents the phenomenon of solariza-

tion. Therefore, the change would be from black to white, and in terms of contact printing this means that we obtain a direct negative from a negative, or a direct positive from a positive.

No matter how long the exposure is continued, the curve will never become zero. This means that the resultant copy film print will have a superimposed veil of fog. Fortunately this veil of fog can easily be removed, should it materially interfere with the clarity or diagnostic quality of the copy film. Certain brands of X-ray film have less terminal fog than other brands.

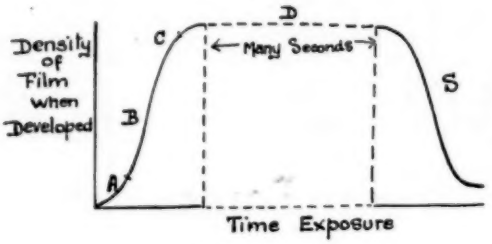

FIGURE I.

If we again refer to Figure I, it will be obvious that the film must be exposed for some time before the phenomenon of solarization—which we wish to use in this method of reproduction—commences to take place. The exact time may be ascertained by the method of strip exposures carried out on a small test X-ray film. Once this optimum time is ascertained, it will be the standard "flash" for the particular electric light and printing distance which you intend to use.

A 100-watt frosted electric bulb at a printing distance of three feet has proved to be satisfactory.

An X-ray film is coated on both sides with emulsion, and in consequence it is necessary to expose both sides so as to ensure that the emulsion on each side has reached the preliminary point of exposure before the phenomenon of solarization commences. It has been found by experiment that an exposure of two seconds to one side of the film and three seconds to the other side will produce a satisfactory "flashing" or blackening and will decrease the subsequent printing time.

The following procedure will produce a satisfactory reproduction; but it must be realized that radiographs in general vary in density and contrast, so that slight modifications in the following technique may have to be adopted in order to obtain a perfect reproduction.

The process is carried out in a photographic dark room.

1. Expose both sides of an X-ray film of the same size as the radiograph to be reproduced, at a distance of three feet from a 100-watt frosted electric light bulb. This is done by placing the film in the printing frame and "flashing" it for two seconds, reversing it and "flashing" the other side for three seconds.

2. Remove the film from the printing frame.

3. Place the radiograph to be reproduced in the printing frame and the "flashed" X-ray film in contact with it, the side "flashed" for two seconds in contact with the radiograph.

4. Print at a distance of three feet in front of the 100-watt lamp, just as if the film was a slow bromide paper. An approximate printing time would be between 60 and 240 seconds. There is an extraordinary latitude in the time of printing, some radiographs requiring more and others less, according to their density; for example, where the radiograph is very dense it will protect the "flashed" film from becoming solarized, but where the radiograph is clear, the "flashed" film will be solarized fairly rapidly.

5. Develop for three minutes at 65° C. Any standard X-ray developer will be suitable ("M.Q." developer). As a general rule, increased development time renders the terminal fog more apparent, but it has the advantage of increasing the contrast of the reproduction.

6. Wash the film, fix it in "hypo", wash it in running water and dry it, exactly as for other radiographs.

In general, the reproduction so obtained is darker than the original; but with strong transmitted light it will be seen that all the qualities of density have been reproduced. It may be that the darker reproduction is to be desired, but a reproduction of the same density and of equal diagnostic value as the original can be obtained by simple reduction in Farmer's solution. The shallow dish previously mentioned is for this purpose and the Farmer's solution must be added to freshly mixed 20% "hypo" solution. Only sufficient Farmer's solution should be added to turn the mixture a pale yellow colour. The degree of reduction must be carefully observed. The completed copy is then thoroughly washed and dried.

Finally, by variations in "flashing", printing and developing times, reproductions of greater or less contrast than the original radiograph may be obtained, so as to emphasize certain features in the reproduction. Contrasting reproductions can be obtained by omitting or diminishing the preliminary "flashing"; but the printing time must be prolonged, otherwise incomplete reversal of the reproduction will result. The slow printing rate is ideal for "screen printing" in order to improve certain features of the original radiograph.

There is a slight loss of detail in the solarized reproduction, owing to the double emulsion of the copy film. This would be eliminated by a single emulsion X-ray film; but these films are not yet available in Australia.

Reports of Cases.

ASSOCIATED CARCINOMA AND TUBERCULOSIS IN ONE KIDNEY.

By J. B. G. MUIR, M.S., F.R.C.S., F.R.A.C.S., F.A.C.S.,
Surgeon, The Royal Hobart Hospital, Hobart.

THE simultaneous occurrence of tuberculosis and carcinoma in an organ must be regarded generally as a pathological rarity, because the incidence of the former is found in considerably younger age groups than the latter, not only in primary but particularly in secondary carcinoma, and the question whether tissue-cell reaction stimulated by invading tubercle bacilli can in any way cause the development of malignant growth in neighbouring epithelium has never been answered definitely.

Primary carcinoma of the kidney occurring in the presence of tuberculous nephritis appears to be very rare. Thus Keen, in reviewing a number of cases in American hospitals, found only 13 in which tuberculosis was associated with primary malignant disease in the same kidney, and came to the conclusion that the occurrence was purely coincidental. The types of associated malignant disease were as follows: hypernephroma, eight cases; adenocarcinoma, three cases; papillary carcinoma of the renal pelvis, two cases.

The following case, in which carcinoma of the kidney developed in a young female patient undergoing sanatorium treatment for phthisis, in whom renal tuberculosis was also present, appears to be sufficiently rare to merit publication.

Clinical Record.

Mrs. G.H., aged twenty-three years, was admitted to the Tasmanian State Sanatorium from the Chest Clinic on November 11, 1945, with a history of an expectorative cough, loss of weight, night sweats, and pain over the scapular region on the left side of the chest, of eighteen months' duration. X-ray examination revealed infiltration of the apex of the left lung with early cavitation, and the sputum contained tubercle bacilli. Attempts at artificial pneumothorax were rendered unsuccessful by numerous pleural adhesions on the left side, and thoracoscopy revealed these to be particularly dense, to contain lung

tissue and to be situated in the vicinity of the subclavian artery, being unsuitable for thoracoscopic pneumonolysis. About two months after her admission to hospital the patient complained that she felt a lump on the left side of the abdomen under the ribs, and on examination a smooth reniform tumour, slightly movable, was felt in the position of the left kidney. Bacteriological examination of the urine showed it to be acid and to contain a trace of albumin and a few pus cells; but no tubercle bacilli were found on repeated examination. Cystoscopic examination revealed a normal bladder, no signs of tuberculous infiltration round either ureteric orifice, but complete lack of function on the left side. An excretion pyelogram revealed good excretion from the right kidney, which had a normal though slightly dilated pelvis, but a complete lack of excretory shadow on the left side. In view of the patient's pulmonary condition it was considered that a "closed" tuberculous pyonephrosis of the renal type was present on the left side and operation was advised.

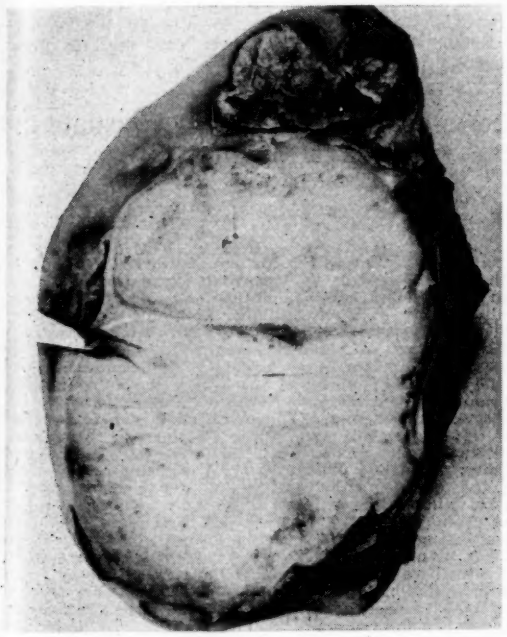

FIGURE I.

Specimen, consisting of the left kidney, split from the outer convex border towards the pelvis. A firm, greyish-white, homogeneous tumour, oval in shape, occupies the greater part of the kidney, projecting into and filling the pelvis. An irregular mass of caseous tuberculous tissue is present in the upper pole, adjacent to but separated from the tumour tissue. The tumour measured 7 by 7 by 10 centimetres, showed a pseudo-capsule, and intimately mingled with kidney tissue. (Two-thirds natural size.)

On February 28, 1946, under high spinal anæsthesia with a 1 : 1,500 solution of "Percaine" administered by Dr. D. Starr, the left kidney, enlarged to the size of a grapefruit, together with the proximal three-quarters of the left ureter (which appeared normal), was removed. The patient stood the operation well and made a completely uneventful recovery, being discharged back to the sanatorium on March 16.

Pathological Findings.

I am indebted to Dr. Campbell Duncan, of the Commonwealth Pathological Laboratory, Hobart, for the following description of the specimen and for the photographs.

Macroscopically the specimen consisted of a rather rounded kidney weighing six ounces. Examination of sections reveals a greyish-white, oval, homogeneous tumour in the lower half, pushing forwards into and entirely obliterating the renal pelvis. The tumour measured 7·0 by 7·0 by 10·0 centimetres; it had a pseudocapsule, and in places mingled intimately with the kidney tissue. At the upper pole of the kidney, adjacent to but completely separate from the tumour, was an irregular caseous mass of tuberculous tissue. This was seen as a typical, ragged-walled tuberculous cavity, which, however, had not yet communicated with the flattened-out renal pelvis.

FIGURE II.

Microscopic appearance. The tumour consists of an even mass of cells divided up into irregular compartments by thin strands of connective tissue. The cells are rounded, deeply staining, and show little mitotic activity. Blood vessels are scanty. In a few places small areas of necrosis are present, but no hæmorrhage. The tumour is considered to be a Grade I carcinoma. No tubercle bacilli could be found in a series stained by the Ziehl-Neelsen method. (× 840.)

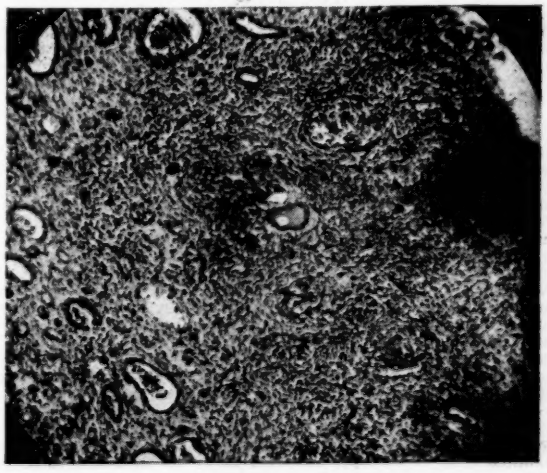

FIGURE III.

Microscopic appearances. This section shows tuberculous granulation tissue invading kidney tissue, with typical giant-cell systems adjacent to large areas undergoing caseation. (× 85.)

On microscopic examination the tumour was seen to consist of an even mass of cells divided into irregular compartments by thin strands of connective tissue. The cells were rounded and deeply staining and showed little mitotic activity. Blood vessels were scanty. In a few places small areas of necrosis were present, but no hæmorrhage. In the tuberculous area in the upper pole (Figure III) were seen typical tuberculous systems with giant cells adjacent to areas of caseation.

The tumour is considered to be a Grade I carcinoma. No tubercle bacilli could be found in sections by means of Ziehl-Neelsen's stain.

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M. R. Keen: "Associated Renal Tuberculosis and Malignancy", *The American Journal of Surgery*, Volume XXV, September, 1934, page 467.

Reviews.

LUPUS VULGARIS.

"THE PROBLEM OF LUPUS VULGARIS", by Robert Aitken, is a book which deals, in five chapters, with the clinical features, treatment, ultra-violet irradiation, tuberculin treatment and the problem of *lupus vulgaris*.[1] The illustrations are very good, and their value is enhanced by a great number being from photographs in natural colour.

The book will be of more interest to British and European dermatologists than to those in Australia, where the incidence of the disease is very small. Almost all Australian patients suffering from *lupus vulgaris* have acquired it before coming to this country. Probably the abundance of sunshine in Australia accounts for the rarity of the disease in the locally born.

The author states his reasons for preferring the arc lamp, rather than the mercury vapour lamp, and points out that the technique of the application cannot be learned from books or papers. The operator must be trained by someone who already has the knowledge.

CARBON MONOXIDE.

SOME twenty years ago the many problems presented by carbon monoxide poisoning, with special reference to gas-works employees, were investigated by Dr. F. R. Kerr, an officer of the Commonwealth Department of Health. A somewhat similar survey has recently been conducted, though with wider scope, in the United States. In "Carbon Monoxide: Its Hazards and the Mechanism of its Action", published under the auspices of the Public Health Service in Washington in 1944, a bulletin has been made available which devotes 179 large octavo pages to carbon monoxide, its chemistry, detection, physiological and pathological actions, production, clinical syndromes, toxicology, prophylaxis and treatment.[2] Strange to say, the medico-legal aspects have been omitted. We have become familiar in recent years with a form of American scholarship which is mostly bibliographic and displays little discriminating and judicial editorship. This brochure does not err quite so annoyingly as most American digests, but the same old fault is discernible of giving equal emphasis to publications widely apart in merit. Unquestionably some writers have rushed into print who knew nothing of the applications of the laws of mass action to the distribution of hæmoglobin between oxygen and carbon monoxide, the quantitative expression of such and the hyperbolic relationship between concentration of carboxyhæmoglobin and the partial pressure of carbon monoxide in the presence of a constant oxygen pressure, and these should be the basis of all investigations in this field. It is just possible that the author of this bulletin is not himself well versed in the physico-chemical theory, for his description of the spectrophotometer and its application to the quantitative estimation of carboxyhæmoglobin in the presence of oxyhæmoglobin shows that he does not understand this instrument of precision. Yet this bulletin is of considerable value as a guide to the literature which has been given a thoroughly good survey within the limitations stated; it may be mentioned in passing that all titles have been translated into English. That portion of the descriptive exposition dealing with the treatment of carbon monoxide poisoning by drugs such as "Coramine", "Cardiazol", ephedrine, lobelin, oil of camphor and the like could well have been omitted, as the articles referred to are of a most unconvincing character. The best part of the bulletin deals with the sources of carbon monoxide in respired air. Here it may be mentioned that Australia is free from at least two of the dangers described; one is that natural gas, so common in North America, has no warning smell as has our illuminating gas, but is rich in the deadly monoxide; the other is that our cities fortunately have not the "sky-scrapers" with "canyon" streets where the air can become progressively vitiated with products of incomplete combustion of petrol. The recommendations for treatment given in the conclusion do not differ from those advanced forty years ago. Proof-reading has been good and the index is excellent.

[1] "The Problem of Lupus Vulgaris", by Robert Aitken, M.D., F.R.C.P.E., F.R.S.E.; 1946. Edinburgh: E. and S. Livingstone Limited. 8½" × 5½", pp. 78, with many illustrations, some of them coloured. Price: 15s. net, postage 7d.

[2] "Carbon Monoxide: Its Hazards and the Mechanism of its Action", by W. F. von Oettingen; Federal Security Agency, United States Public Health Service; Public Health Bulletin No. 290; 1944. Washington: United States Government Printing Office. 9" × 6", pp. 263. Price: 35 cents.

Notes on Books, Current Journals and New Appliances.

SOIL AND CIVILIZATION: A WARNING.

FOR the first time in the history of humanity a crumbling civilization is capable of discerning the cause of its decay. "Soil and Civilization" is another warning, particularly to Australia, a country rapidly becoming controlled by industrial cities, that if steps are not taken to preserve the fertility of her soil, then disaster will overtake her in the future.[1] A city can be so large that it becomes a parasite on the land that supports it. Australia wants "young men of the mountains trained as foresters", and not huge water conservation schemes. Elyne Mitchell considers that a real love of the land with an intense love of the individual's birthplace, is the greatest influence for building a true civilization. We have a reputation for the quantity and quality of our primary products, but in gaining this reputation we have ruined much of the land from which the products were thoughtlessly wrung. In stressing that soil must be fertile in order to grow healthy plants, she writes: "Energy, which comes from light and which we receive through plants, may give us strength and imagination to erect a cathedral for the worship of God, or it may be used by the pilot and the bomb that razes the cathedral to the ground." "Soil and Civilization" is written in a manner that will appeal to the average man, in whose ranks must be sown the seed of Elyne Mitchell's warning.

THE PLAINS RAT KANGAROO AND OTHER ANIMALS.

IN "The Red Centre", H. H. Finlayson tells of his search for and rediscovery of *Caloprymnus* (which to the man in the street is better described as the plains rat kangaroo).[2] The previous and only other specimens were obtained by John Gould in 1843, and since then it has been thought that the animal was extinct. As well as this story, there are several chapters dealing with aspects of life in the centre, including two in which the author pays tribute to that usually despised animal, the camel. He knows well country that is little known, but points out that human infiltration will mean the inevitable disappearance of some fauna and flora. Mr. Finlayson has told us many interesting things in a most acceptable manner. He has a nice choice of phrase and outcrops of a dry humour. The book is in a pocket edition.

[1] "Soil and Civilization", by Elyne Mitchell; 1946. Sydney, London: Angus and Robertson, Limited. 7½" × 5", pp. 152. Price: 4s. 6d.

[2] "The Red Centre: Man and Beast in the Heart of Australia", by H. H. Finlayson; 1945. Sydney, London: Angus and Robertson Limited. 7½" × 5", pp. 154, with illustrations. Price: 1s. 6d.

The Medical Journal of Australia

SATURDAY, AUGUST 24, 1946.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

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THE FORTHCOMING INTERNATIONAL MEDICAL CONFERENCE AND ITS SIGNIFICANCE.

SHORTLY after the war of 1914-1918 Fritz Kreisler, the renowned violinist, toured Australia. At a journalist's luncheon held in his honour at Sydney he had something to say about the promotion of understanding and goodwill among the nations. He pointed out that devotees of the arts, of science and of literature could do more to create a lasting peace than statesmen and others who drew up treaties of peace. This incident, which has probably been mentioned before in these pages, created a great impression among those who were present. Kreisler, of course, had been an enemy subject, but he was an international figure; he could be said to belong to every nation, for there were in every country those who shared his devotion to art and because of what he had given to it, looked on him as one of themselves. There is a common heritage also in science and in literature and indeed in every activity of the human spirit. There is no doubt whatever that the world would be a much more pleasant place to live in, that a lasting peace would be brought nearer, if members of different nations who are devoted to the arts, to science, to literature and so on knew more of one another—if they appreciated points of view different from their own, if they knew how other peoples lived, what their aims were and what counted most with them. For this reason great importance is attached to the international medical conference which is to meet at the end of September, 1946, at London.

The conference, which is being convened by the British Medical Association on behalf of the *Association professionnelle internationale des médecins*, will be held at British Medical Association House, Tavistock Square, to consider the means of promoting closer ties among the national medical organizations in the different countries. Before the recent war the *Association professionnelle internationale des médecins*, generally known as the A.P.I.M., was the only organized body that provided a means of international medical contact in the spheres of professional medical matters and medical sociology. It has been said that the A.P.I.M. was not very popular and that its activities were mainly medico-political. Be that as it may, a new body is to be set up which will replace the A.P.I.M. The proposal to form a new international organization is the result of a conference held by the British Medical Association in June, 1945, and attended by medical practitioners from foreign countries who were in England at the time. A desire was manifest at that conference for an international organization with a broader sphere of activity than that formerly undertaken by the A.P.I.M. These facts were all set out in a letter, received by the General Secretary of the Federal Council of the Association in Australia from the Secretary of the Parent Body, in which the Federal Council was asked to send one or two representatives to attend the conference. The British Medical Association and the A.P.I.M. will submit to the conference a proposal that a new organization shall be formed and that it shall engage in the following activities: (*a*) to undertake an exchange of information on medical affairs; (*b*) to promote closer ties among the different national medical organizations; (*c*) to encourage better international relations generally, by professional contact and otherwise; (*d*) to embody, continue and extend the work formerly undertaken by the A.P.I.M. If the proposal is accepted, the conference will be asked to consider the constitution of the new body, including the following points: (*a*) the name of the new organization; (*b*) eligibility for membership (it will be suggested that membership should be confined to national medical organizations); (*c*) the governing body; (*d*) subscriptions; (*e*) location of headquarters; (*f*) appointment of officers, secretariat and executive committee; (*g*) language or languages; (*h*) method of procedure for carrying out the objects of the association.

Acknowledging that medicine, particularly in its scientific aspects, is a common meeting ground for groups of men and women in every nation, and recognizing the value of international collaboration in the higher spheres of human activity that has already been mentioned, we must agree that the launching of a new organization of the kind suggested would, if the project was wisely handled, be most desirable. It will therefore be useful to inquire into some of the means that might be used in the handling of the project. It will be clear that the desired ends may be attained only if the different peoples of the earth know more about one another and understand one another. This may be brought about in two ways—by the written word, faithfully and truly recorded, and by personal contact of individuals. Thinking on these lines, we may imagine several kinds of activity. In regard to the written word, it should be possible to set up a central clearing house for information at the headquarters of the new organization, something like the Far Eastern Bureau of the League of Nations which disseminated information about the incidence of different diseases before the last war. The information would be available to government medical departments of the different nations and to the editors of medical journals that they might publicize it among the medical practitioners of their own countries. Departmental heads would collect the type of information useful to them; and editors would use material likely to make the practitioners whom they served cognizant firstly of

what was happening in places of which they knew little, and secondly of what practitioners in these places were thinking. Again, if editors were sufficiently enterprising they would solicit articles from representative and reliable contributors in different parts of the world. In regard to the personal contact of individuals the matter is admittedly difficult. Some suggestions may be made. The first thing that comes to mind is the occasional interchange of medical teachers between medical schools of different countries. Language difficulties might restrict this to a large extent, but in some instances it should be possible for arrangements to be made. The most fruitful plan would be the establishment of research fellowships in research institutes of different countries to which suitable graduates from other places might be appointed. An exchange of fellows between laboratories in different countries might be arranged. A third method would be the exchange for a year or two of resident medical officers in the teaching hospitals of different countries. If this was done the countries concerned would have to be prepared to grant to the newcomer such registration as he would need for the carrying out of his duties. These suggestions do not cover a great number of persons, and they may cause some misgiving because their acceptance would mean the breaking down of certain barriers that now exist. However, if they were carried into effect even in a small way, in the course of a few years there would be found in places widely separated from one another nuclei of intelligent and scientifically trained persons whose vision was not bounded by the confines of their own country, who knew that the point of view of other peoples was at least worthy of consideration and who could preach a gospel of national tolerance and understanding. It will probably be said that these are idealistic suggestions. They are none the worse for that, and they do offer some means by which medicine in one country can learn at first hand something of medicine in another. The interchange of men of the younger generations would be much more valuable in the long run than the kind of contact that takes place at international medical congresses, valuable though these gatherings undoubtedly are.

Current Comment.

THE GENERAL MEDICAL COUNCIL OF GREAT BRITAIN.

THE ethical standards set up by the General Medical Council of Great Britain have for many years been recognized as applicable in Australia and indeed in other parts of the British Empire. That the Council has statutory powers to enforce adherence to its standards is perhaps well known; but the medical profession has always suffered from the confusion that exists in the public mind between the statutory body and such a private association as the British Medical Association which has no statutory powers. During recent months the General Medical Council has been the subject of much discussion in the Old Country, one of the reasons being the removal of a practitioner's name from the medical register on the grounds of certain evidence and its restoration to the register after a successful legal action by the practitioner for slander. A private association can determine its own sphere of action and its own rules, but a statutory body is dependent in regard to its functions and powers on the actions of the legislature. On May 28, 1946, Sir Herbert Eason, President of the General Medical Council, pointed out[1] that since November, 1944, it had had a committee working at a draft bill which would bring the medical acts in Britain more closely in conformity with modern requirements. He explained that the draft bill was so long that there was no chance of its introduction into Parliament within a reasonable time. A short draft bill containing only urgent provisions was therefore being prepared. These provisions included the constitution of the Council and its powers, and also had to do with the institution of an interim period between the passing of a qualifying examination and the registration of a practitioner. That this last-mentioned measure is being attended to is a matter of satisfaction, for we cannot but recall the attitude of the General Medical Council when a provision of this kind was introduced into some of the Australian medical acts. (See THE MEDICAL JOURNAL OF AUSTRALIA, April 13, 1940, page 517.) That the constitution and powers of the Council are not regarded as satisfactory by the people of Britain is clear from a leading article which appeared in *The Times* of June 6, 1946. Here it is bluntly stated that, "even within its rules, the Council fails to fulfil its essential purposes to the general satisfaction". *The Times* holds that the present constitution of the Council makes it unsuitable for its duties in medical education and the ethical control of the register. Only five members are elected by the profession, and the remainder tend to be elderly representatives of various bodies. These happenings should not pass unnoticed by Australian medical boards. Their results will be awaited with interest, for we can all learn from one another.

GOUT: STILL A FORGOTTEN DISEASE.

PROGRESS in medical science leaves in its wake many discarded ideas, outmoded treatments, and discredited methods, but there is some merit in looking back as well as forward, as occasionally something important or valuable is left behind. J. P. McCracken, P. S. Owen and J. H. Pratt, in a recent article on gout, point out that ten years ago Herrick and Tyson published a paper entitled "Gout, a Forgotten Disease".[2] They draw attention to a fact which they prove in their own paper, that gout is still often forgotten. Perhaps many people think that Sydenham lived and wrote a long time ago. That is true, for his classic description was written 260 years ago. Others point out that once gout was blamed for many conditions now known to have a completely different ætiology; this is true also. But the clear-cut picture of acute gout is one that should not remain unrecognized. These writers give a striking history of an elderly woman who damaged her ankle and who a few days afterwards had a highly characteristic attack of pain in her metatarso-phalangeal joint, associated with swelling and excessive tenderness. After some days the symptoms were unabated and the joint on the other foot was similarly affected. Four doctors examined her during this time, but did not make a diagnosis of gout. In fact when a further medical suggestion was made to the patient that she had gout and should have colchicine, two of them advised against this treatment on account of its danger. Examination of the blood showed that the uric acid content was 7·0 milligrammes per hundred millilitres, though the authors remark that this confirmation was not needed. This patient was overweight and aged sixty-eight years, thus conforming to Sydenham's description of the few female sufferers from gout as being chiefly the aged and masculine. It is interesting on reading the record of this particular patient to note that there was a strong family history and that the story of the attack when put together by the taking of a careful case history could hardly suggest anything else. Other diagnoses suggested were bursitis and acute infection of the part, for which sulphonamides

[1] *The Lancet*, June 1, 1946.

[2] *The Journal of the American Medical Association*, June 1, 1946.

were prescribed, and later orthopædic treatment was advised. However, it is perhaps not well to dwell too much on the mistakes that all men make in all walks of life. The authors, wishing to be helpful, have collected 100 cases of gout and compared their findings with those set down in the recent literature on the subject. Of their 100 patients, 93 suffered from acute gout. Few of them became crippled as the result of recurring attacks. In 10 cases many joints were affected in the course of an acute febrile disturbance, which lasted weeks in some cases. As Hench and his associates at the Mayo Clinic have pointed out, an arthritis occurring acutely or subacutely and then remitting is likely to be gout. Most of the patients were men, only nine being women. They found a low incidence among Negroes, as others have also noted. The ages of the patients on the occasion of the first attack varied to an extraordinary degree, the extremes being 19 and 73 years, but the average age was 56 years. In only 18 cases was there a clear family history of gout. Obesity was common, being recorded in 41 cases, but dietary habits on the whole were not remarkable. Over half the patients admitted to the consumption of alcohol in amounts fairly evenly divided between the moderate and the heavy. Precipitating factors did not appear to be of much importance: a history of trauma was given in 18 cases. The joint first involved was the great toe in 78% of cases, and sooner or later this joint was affected in practically every patient in this series. Tophi were found in 32 instances, and in 23 of these the site was the ear; the other locations for tophi show in their wide distribution that a careful examination is necessary. Estimation of the blood uric acid content was usually confirmatory, but not invariably so. In 23 cases there was some evidence of renal damage. X-ray examination was on the whole not very helpful.

Since the authors have set out to prove that gout is still in danger of being forgotten, it is most interesting to read that in 41 of their 100 cases previous attacks of gout had not been correctly diagnosed, and, further, that in 32 the disease had been in evidence for five years or more before its nature was recognized. Treatment by colchicine was the most satisfactory method. In 44 of their cases, of which good notes have been available, the results from colchicine were excellent. In only a few cases was the result other than rapid and dramatic improvement, with a dosage of from 0·5 to 1·0 milligramme every hour for four to eight doses. In 14 cases cinchophen was used with good results, and in no instance was any toxic effect observed, the drug being used for a few consecutive days in doses of from 1·5 to 3·0 grammes a day. In some diseases doubt as to the exact diagnosis affects treatment but little. Gout is emphatically not one of these, for the relief of the patient, which is a most urgent matter for him in acute podagra, is not possible unless an accurate diagnosis is made. It may be said finally, without belittling the help of the biochemist, that gout may be recognized by the same means as those used by Sydenham.

A CLINICAL SYNDROME FOLLOWING EXPOSURE TO ATOMIC BOMB EXPLOSIONS.

SERIOUS results following undue exposure to X radiation have often been described, and the effects of this noxious influence on the functions of the bone marrow and the liver are well known. In fact the changes occurring in the vulnerable bone marrow, not only after exposure to radiations of certain wave-lengths but also after poisoning by a number of well-known chemical compounds, have aroused new interest in the other apparently spontaneous or "idiopathic" types of blood dyscrasia. Now comes another terror to our world, the possibility of widespread blood disorders following the violent release of atomic energy by the explosion of that latest ballistic pride of civilization, the atomic bomb. Presumably it is permissible to extend ballistics as a science to include not only the constantly enlarging missiles designed by man to destroy his brothers, but also the infinitely small ones wrested from the workshop of Nature. A report has been published by Colonel Paul D. Keller on observations made on twenty-one patients who were admitted to the Osaka University suffering from the after-effects of the explosions of atomic bombs dropped on Hiroshima and Nagasaki.[1] Patients who had also suffered from the effects of blast or burns were excluded from the series. Death resulted in five cases. All the patients were Japanese; their average age was thirty years, ranging from twenty to fifty-two, and three were women. A significant fact is that none of the observed patients had to enter hospital until after a month had passed from the times of the bomb explosions. Even more interesting is a study of the actual environment of the patients at the time. Their distance from the centre of the explosion varied from 50 to 4,000 metres. Seventeen of the people affected were in buildings at the time: two of these buildings were of concrete. At least half the patients seem to have been within a radius of 500 metres. Their experiences with regard to blast varied. Only five recalled feeling a concussion wave: one of the victims who was outside was knocked unconscious, the other felt no blast at all. Only a few heard a noise as of an explosion, and only a minority seemed to have noticed a flash of light. Any wounds sustained by these people were slight and had healed before other symptoms were observed. Within five days of exposure symptoms of nausea, anorexia and vomiting appeared, of varying severity, and later fever occurred in over half the cases. There was considerable variation in the time of onset of fever; it was delayed even as long as twenty-five days, but in other cases it appeared in the first few days. Loss of hair was a common symptom; in fact, although the records are not complete, it seems probable that nearly every person had some degree of alopecia of the scalp. The average time of onset of this effect was the eighteenth day. Occasional loss of hair from the eyebrows and beard was noted, but the body hair did not seem to be affected. The actual cause of admission to hospital was bleeding in nine cases, from the gums and naso-pharynx in most instances, and in the others under the skin. Excessive fatigue was almost universal, and increased in degree up to the time of admission. Examination revealed slight enlargement of lymph glands in a few cases and jaundice in two. Slight œdema of parts of the face was seen in a few, but pallor was not conspicuous. But most striking and important were the pathological changes found in the blood. Some reduction in the red cells was universal, few of the counts reaching 4,000,000 red cells per cubic millimetre, and numbers being below 3,000,000. The hæmoglobin values varied widely, but were considerably reduced in most cases. On white cell production fell the brunt of the damage, as might be expected. In a few instances the leucocytes numbered a few hundreds only to the cubic millimetre, and several marrow examinations carried out on the severely affected patients showed very low percentages of granular cells. The blood sedimentation rate was much increased as a rule, and this determination was found to be of prognostic value. Clotting times were not abnormal, so far as observations went, but bleeding times were considerably prolonged in the patients examined, the thrombocytes being also much reduced in number. Further studies indicated that disturbance of liver function had taken place. The limited observations showed that tyrosin and urobilinogen were present in the urine, and the blood plasma contained increased amounts of bile pigments, but had suffered profound loss of proteins, chiefly albumin. It will be seen that the picture strikingly resembles that seen after excessive X radiation.

Apparently there are factors as yet unknown making the incidence of these severe hæmopoietic disturbances capricious. But shelter as the world has known it up to date, in the sense of protection from the hazards of the "ordinary" air raids, would seem to be completely inadequate. Perhaps the Bikini studies will reveal much that is so far not well understood; but it is clear that the human race is, with its passion for self-destruction, trying to make total war a reality.

[1] *The Journal of the American Medical Association*, June 8, 1946.

Abstracts from Medical Literature.

RADIOLOGY.

Acute Hæmatogenous Osteomyelitis, Treated with Penicillin.

W. A. ALTEMEIER AND H. G. REINECKE (*American Journal of Roentgenology*, November, 1945) state that the röntgenographic changes in bone occurring in acute hæmatogenous osteomyelitis treated with penicillin are of particular interest. Early in the disease, during the first four to ten or more days, the röntgenograms are of no practical value in detecting the nature of the disease. This emphasizes the fact that the diagnosis of acute osteomyelitis is purely clinical at the time when early and adequate treatment with penicillin will minimize or prevent damage of bone. In many instances penicillin therapy has sterilized the blood stream and has brought the generalized and localized manifestations of infection under control before any evidence of bone damage became obvious. Later in the disease, usually after the cessation of chemotherapy, a succession of röntgenographic changes occurred. These changes varied with the age of the patient, the severity of infection, the duration of infection before treatment with penicillin, the adequacy of therapy, and the type of infecting bacteria. Periosteal reaction, patchy areas of demineralization and rarefaction of the involved bone, and breaks in the adjacent cortex were early signs which usually became evident ten to fourteen days after the onset of the illness. These findings increased in extent and degree, and were invariably interpreted by the röntgenologist as representative of "an extension of the osteomyelitic process". The authors have learnt to interpret the areas of rarefaction and breaks in the cortex of the involved bone as a measure of spontaneous absorption of the bone destroyed early in the course of the infection, rather than as a measure of an extension of the osteomyelitic process. The process suggests that adequate penicillin therapy given early arrests and controls the infection, converting an area of septic necrosis of bone to one of aseptic necrosis. The spontaneous absorption of the dead bone is followed by recalcification of the involved area, often with reestablishment of normal or nearly normal bony architecture. Reconstitution of the bone was accomplished with less resultant bone sclerosis than that following other previously used forms of treatment.

Reflex Hyperæmic Deossification.

A. A. DE LORIMIER, W. L. MINEAR AND H. B. BOYD (*Radiology*, March, 1946) state that deossification should be considered reflex and hyperæmic in type when the Röntgen picture shows localized areas of bone dissolution, rendered conspicuous because of the substantial structure of contiguous bone. The areas of rarefaction may be disseminated through a large portion of a bone or bones, presenting the appearance of discrete mottlings. Such a picture would seem to indicate hyperæmia of terminal branches of the nutrient arteries together with their anastomotic connexions with cortical perforating vessels. The rarefaction may be conspicuously concerned with the metaphyseal regions, producing the appearance of metaphyseal bands (especially in the case of the distal tibia), or they may be conspicuously concerned with the ends of bones. Such evidence would seem to signify hyperæmia involving the cortical perforating metaphyseal vessels and their anastomotic connexions with the epiphyseal vessels (and to a lesser extent with the communicating channels from the nutrient artery). The rarefactions may predominantly be concerned with the zones beneath the subchondral articular cortices. Such evidence would seem to signify hyperæmia involving the terminal arcuate vessels. In the earlier stages of reflex hyperæmic deossification, even as early as three weeks after the onset of irritation, any one of these three vascular distributions may be characterized by conspicuous rarefaction. In reaction to intense irritation or after several months of lesser degrees of irritation, the rarefaction may involve a combination of two or all three of these vascular beds. Ultimately, the Röntgen appearance may be that of a blending of the patterns—a diffuse mottling of dissolution. Discrete mottlings of deossification, distinct bandings, deossification beneath the subchondral cortices, or diffuse mottlings—any one of these or a combination of them should be recognized as a sign to serve as a challenge to the röntgenologist as well as to the clinician, a challenge to identify the cause. Reflex hyperæmic deossification may be produced by a variety of ætiological factors: (*a*) trauma, including relatively minor degrees (simple contusions, sprains, over-energetic physical therapy) and such major degrees as actual fractures or surgical procedures; (*b*) infections, including chronic cellulitis, localized osteomyelitis and infectious arthritis; (*c*) neoplasms, including, in particular, giant-cell tumours and other highly vascular lesions.

The Cervical Intervertebral Disk.

J. E. WHITELEATHER, R. E. SEMMES AND F. MURPHEY (*Radiology*, March, 1946) state that the two divisions of the spine which undergo the greatest stress are the lower lumbar and lower cervical segments. The only significant difference is that in the cervical region the spinal canal and intervertebral foramina are smaller than in the lumbar spine; hence a small herniation is more likely to be symptomatic. Lateral herniation of the cervical disk usually follows a relatively slight trauma, although some patients are unaware of any specific injury. Not all displacement of disk tissue results in clinical symptoms. Lesions which do produce nerve root compression are of two types: (*a*) Extruded nodules of *nucleus pulposus*, which are soft and radiolucent, but are easily recognized when the posterior ligament is incised. These later undergo ossification and, becoming visible, are often interpreted as arthritic spurs. (*b*) Protrusions of the disk with neither rupture of the *annulus fibrosus* nor extrusion of the *nucleus pulposus*. Ossification occurs in the late stages of this type also. It is important to note that a recent or acute protrusion may be present without the production of any X-ray abnormality. In most instances, however, there will be a loss of cervical lordosis or even a reversal of curvature. This is due, presumably, to muscle spasm, an involuntary attempt to decrease nerve compression by opening of the posterior intervertebral spaces. Narrowing of the intervertebral space follows loss of tension and substance of the disk. It may be observed within a few months after the onset, but as a rule requires many months or years. In the early stages the space is usually wedge-shaped, resulting in a peculiar segmental reversal of curvature that involves only two vertebral bodies. As degeneration continues, the intervertebral space becomes uniformly narrowed and irregular. This process is usually accompanied by proliferation of bony spurs around the anterior margins of the interspace, often of the "parrot-beak" variety. Extruded disk material tends to ossify and become attached to the postero-lateral aspect of the vertebra. Additional proliferation of bone occurs in the posterior ligaments or disk capsule. In the oblique view, the resulting nodule or osteophyte can be seen projecting into the foramen, rendering it somewhat kidney-shaped. This further increases nerve root vulnerability.

Effusion of the Knee Joint.

ARNOLD L. BACHMAN (*Radiology*, May, 1946) describes the X-ray findings in the soft tissues about the knee in cases of knee-joint hydrarthrosis and discusses the anatomical factors in the production of these signs. The author states that the synovia of the base of the suprapatellar pouch passes upward from behind the patella through the lower portion of the area of fatty radiolucency in the patello-condylar recess, and, being more radio-opaque than the fat, is usually seen as a linear or thin band-like density, 0·2 to 1·2 centimetres in thickness, which separates the small triangular area of fatty radiolucency in front from the main portion of the prefemoral fat. The linear bursal opacity then merges with the shadow of the quadriceps tendon and loses its identity, since the bursa and adjacent tendon are of the same radiodensity. In cases of effusion the fluid in the knee joint accumulates first and to the greatest extent in the suprapatellar bursa. A lesser amount of fluid is located in the space just below the patella and presses the infrapatellar fat pad forward. The smallest quantity of fluid is situated in the joint space between the femur and tibia. As the bursa expands with the fluid, the line or small band of water density between the main collection of prefemoral fat and the small triangular area of fatty radiolucency in the patello-condylar recess becomes increasingly wide. It represents the fluid-distended base of the suprapatellar bursa. With further accumulation of fluid, the entire bursa becomes distended. In about half of the cases it can be completely visualized, since in this group the fluid-filled bursa is surrounded by a thin layer of comparatively radiolucent fatty tissue. In other cases the bursa is incompletely bordered by the small rim of fatty tissue and is thus visualized only in part. The fluid in the joint just behind the infrapatellar fat pad also distends

the synovial space and presses the upper portion of the fat forward. This anterior displacement of the upper part of the infrapatellar fat pad is easily recognized on the skiagram. Further accumulation of fluid in this region pushes itself anteriorly. The weight-bearing portion of the knee joint between the tibia and femur contains a minimal amount of fluid, and widening of the joint is practically never observed except, perhaps, in cases of extreme hydrarthrosis.

Chronic Ulcerative Œsophagitis with Ulcer in Œsophageal Varices.

GEORGE STEINER (*The British Journal of Radiology*, April, 1946) states that cases of œsophageal ulceration, though not common, are probably missed in many examinations. A circumscribed crater-niche is seldom seen in the œsophagus. The early stages are often missed and chronic inflammation and fibrosis have supervened at the time of the examination. These may obscure a present ulcer, but in other cases such fibrosis may be the only pathological condition left after an ulcer has healed. Many benign strictures in the lower third probably represent a late fibrotic stage of healed ulceration. Indirect radiological signs are therefore of relatively greater importance in these cases than in cases of gastric or duodenal ulceration, where, with good reason, the chief emphasis is laid upon the demonstration of "direct" signs. Certain associated changes in function or structure, namely, delay in the passage, spasm, stenosis, dilatation, abnormal peristaltic phenomena and hypertrophy of the coat, point only to the œsophagus in general as the site of disorder and commonly occur in other œsophageal conditions as well. Delay in the passage of an opaque meal does not necessarily indicate spasm or stenosis, but may simply be brought about by swelling of the mucosa. In the region of the hiatus this may be emphasized by an additional increase in the normal pinchcock action—a kind of external sphincter effect—of an abnormally oblique slit-like diaphragmatic opening, which latter may be observed in normal individuals without symptoms. Other signs are "indirect" only with regard to the possible presence of an ulcer, but they represent direct evidence of chronic inflammation or swelling. They consist of irregularity of rugal alignment, persistent coarsening of or granular thickening along the folds, loss of pliability or even rigidity of the rugæ, ill definition or loss of the mucosal pattern. There may be, in addition, evidence of perioesophageal adhesions within or above the hiatus.

PHYSICAL THERAPY.

Teratoma of the Testis.

J. L. BARNER (*American Journal of Roentgenology*, September, 1945) makes a report on the treatment in an army general hospital of sixty-five patients suffering from teratoma of the testis. Of all malignant neoplasms among white personnel in the American Army, 7·2% were testicular tumours. The average age of incidence was twenty-eight years. Of the sixty-five patients, twenty-seven had been treated for conditions other than teratoma before the final diagnosis was reached. Epididymitis, orchitis and hydrocele were the three common incorrect diagnoses. The most frequent symptom was painless swelling, but in six patients the tumour was found on routine examination. With Ewing's classification the pathological distribution was as follows: adult embryoma, two cases; embryoid, teratoid or mixed tumours, two cases; embryonal malignant tumours, 61 cases. The method of treatment followed was in all cases early operation followed by irradiation. The operation was orchidectomy with removal of the cord and accompanying structures high at the internal abdominal ring. Irradiation was commenced as early as possible, usually three to five days after the operation. In those cases in which no metastases were present the regions irradiated were the site of operation, including the scrotum and inguinal glands, the mid-abdomen, epigastrium and two posterior fields. If metastases were known or suspected the mediastinum was also included in the irradiated area.

Aerootitis and its Prevention by the Use of Radium.

Aerootitis in an editorial in the *American Journal of Roentgenology*, April, 1946, is defined as an acute or chronic traumatic inflammation of the middle ear caused by a pressure difference between the tympanic cavity and the surrounding atmosphere commonly occurring during changes of altitude in aeroplane flights. One of the most common causes is enlargement of the pharyngeal and tubal tonsils causing blockage of the Eustachian tube. A similar condition will cause gradual deafness in children. The American Air Force carried out extensive work on this condition. In one group 778 men with lymphoid hyperplasia were irradiated prophylactically, and of these 74% showed subjective and 89% objective improvement. The method first used was to pass a cotton swab moistened with 20% cocaine solution along the floor of the nose; then two radium applicators were introduced, one on each side. These consisted of a radium-containing chamber attached to a long handle. The chamber itself was 2·0 centimetres long with an outside diameter of 2·3 centimetres. The amount of radium used was 50 milligrammes. At first the time of treatment was 6·6 minutes; later this was raised to 8·5 minutes and the treatment was repeated twice, at intervals of thirty days. No untoward reactions were noted. Fowler (1944) reported 69% of full recoveries among his eighty patients, by using 50 milligrammes of radium with 0·5 millimetre platinum filter for one hour to each side. The editorial stresses the frequency of this condition and its importance in these days of frequent air travel as well as the smaller number of cases in which the lymphoid hyperplasia in childhood may lead to a slowly progressive deafness.

External and Internal Thorium-X Therapy.

K. F. NAGELSCHMIDT (*The British Journal of Radiology*, January, 1946) reports that thorium-X can be dissolved in water, alcohol, varnish *et cetera*, mixed with ointment, incorporated in plasters or applied with bandages. The most effective method of using thorium-X for skin lesions is to use thorium-X varnish or the alcoholic solution which is painted on and then covered with a layer of flexible collodion. From one to five layers of each may be needed. The external indications for its use are eczema, chronic dermatitis, lichen Vidal, X-ray and radium scars, psoriasis, especially of the scalp and nails, *nævus flammeus*, and also parasitic infection of the nails. Horny warts after scraping and softening of the outer layers with salicylic acid often respond well. Furunculosis of the axilla and interdigital eczema are often cleared up after other methods have failed. The varnish and alcoholic solution are used in strengths of 500 to 4,000 electrostatic units per millilitre. In most chronic skin conditions the strength is 1,500 electrostatic units per millilitre, but warts require the stronger solution. In regard to internal indications, thorium-X is of great value in myeloid leuchæmia in reducing the number of circulating leucocytes. Some alleviation has been obtained in rheumatoid arthritis by intravenous injection of thorium-X in saline solution and also with the solution by mouth. Doses of 50 to 150 electrostatic units per day are given by mouth. Some cases of splenomegaly which proved resistant to deep X-ray therapy have responded to intravenous injections of thorium-X. The author also maintains that small doses *per os* are a powerful general tonic.

Sarcoma of Bone Treated by Radiotherapy.

GWEN HILTON AND L. E. GLYNN (*The British Journal of Radiology*, May, 1946) report a case of sarcoma of bone treated by radiotherapy. The patient was first seen in July, 1933, with a history of five weeks' pain in the right thigh. X-ray examination revealed slight expansion of the upper third of the right femur with thickening of the cortex. The periosteum was raised and multiple extraperiosteal spicules of bone at right angles to the shaft gave the "sun-ray" effect. The differential diagnosis was from sclerosing osteogenic sarcoma, Ewing's tumour, metastatic sarcoma, syphilitic osteitis and inflammatory condition of bone. The diagnosis reached was osteogenic sarcoma of bone and irradiation was begun in July, 1933. The pain and swelling disappeared, the general condition improved and the affected area gradually calcified. In January, 1935, pain recurred in the thigh and similar radiographic appearances were found just below the treated area. Further irradiation was given and the tumour again disappeared. The patient began some months later to develop post-irradiation changes, atrophy of the skin, telangiectasis and brawny thickening of the subcutaneous tissue with muscular wasting. In June, 1943, ten years after the treatment, the patient was involved in an air raid, and the thigh was fractured at the site of the tumour. After thirteen weeks' immobilization there was no sign of union. Amputation was advised, and this was finally carried out in November, 1944. The upper end of the femur was almost entirely composed of cancellous bone, the changes being ascribed to radiation osteitis. No evidence of sarcomatous tissue was found.

Bibliography of Scientific and Industrial Reports.[1]

THE RESULTS OF WAR-TIME RESEARCH.

During the war a great deal of research was carried out under the auspices of the Allied Governments. It has been decided that a large proportion of the results of this research should now be released for general use.

The United States Department of Commerce, through its "Publication Board", is now issuing abstracts of these reports in the form of a "Bibliography of Scientific and Industrial Reports". The complete bibliography is being received in Australia, and extracts likely to be of interest to readers of this journal will be reproduced as far as practicable each week.

The original reports may be obtained in two ways: (a) Those marked with an asterisk may be obtained by approved applicants without cost on making application to Secondary Industries Division of the Ministry of Post-War Reconstruction, Wentworth House, 203, Collins Street, Melbourne, C.1. Copies are available for reference in public libraries. (b) In other cases microfilm or photostat copies of the original report may be purchased from the United States through the Council for Scientific and Industrial Research Information Service. Readers desiring to avail themselves of this service should send the Australian equivalent of the net United States price to the Council for Scientific and Industrial Research Information Service, 425, St. Kilda Road, Melbourne. S.E.2. All other charges will be borne by the Council for Scientific and Industrial Research.

Further information on the subjects covered by the reports and kindred subjects may be obtained by approaching the Council for Scientific and Industrial Research Information Service, the Secondary Industries Division, Department of Post-War Reconstruction, or the Munitions Supply Laboratories (Technical Information Section), Maribyrnong, Victoria.

McCARTHY, CHARLES L. The medical faculty of the University of Leipzig. Off. Pub. Bd., Report, PB 540. 1945. 27 pp. Price: Microfilm, 50c.; Photostat, $2.00.

Enrolment figures, curriculum, post-graduate training and pay discussed. State (Nazi) control of medical students and graduates mentioned. The school and hospital were badly damaged by bombing in 1943 and again in 1945. A description of the present condition of the building is given. New work done during the war is mentioned and discussed in some detail. The fields covered are: (1) Internal medicine and neurology; lipoid diseases. (2) Surgery and neurosurgery. (3) Skin and syphilis. (4) Orthopædics. (5) X rays. (6) Miscellaneous.

McCARTHY, CHARLES L., SCHLUMBERGER, HANS G., AND BUCKY, THOMAS LEE. Miscellaneous interviews on medical practice and research in Germany. Off. Pub. Bd., Report, PB 498. 1945. 21 pp. Price: Mimeo., 25c.

Subjects covered: malaria immunity, typhus vaccine and typhus diagnosis, tuberculosis, skin and venereal diseases, neurologic diagnosis, neurology and psychiatry, gastroenterology, psychiatric therapy, orthopædics (with diagrams), pathology, insect attractants, and the insertion of nails into the bone marrow channel in the treatment of fractures.

Report on the German dental industry. Off. Pub. Bd., Report, PB 96. 1945. 8 pp. Price: Mimeo., 10c.

Interview with Emil Huber, wholesaler of dental products. He supplied dental instruments and supplies to the German Army, revealed the development of plastic materials for direct fillings. Reports on several major dental manufacturing and supply houses. Formulæ for dental alloys are given.

REYNOLDS, M. K., WEDDEL, F. J., AND HENZE, CARLO. Installations of medical interest in the Göttingen area (Germany). Off. Pub. Bd., Report, PB 235. 1945. 11 pp. Price: Mimeo., 25c.

This report covers a number of scientific institutes and manufacturing establishments in Gottingen that are of medical interest. The following installations were visited: the Hygienic Institute, Medical Clinic, Skin and Venereal Disease Clinic, Veterinary Institute, Municipal Slaughterhouse, Institute for Forensic Medicine, Pharmacological Institute, the Winkel-Zeiss Optical Works, Sartorius A.G., and the Schneider Optical Works. The subjects dealt with are communicable diseases, sulphonamides, an ultracentrifuge, veterinary diseases, food inspection, and other items.

RICE, J. B. Tropical medicines and other medical subjects in Germany. Off. Pub. Bd., Report, PB 499. 1945. 21 pp. Price: Mimeo., 25c.

Collection of reports on German research in medical and related fields. Principal topics covered malaria, Leishmaniasis, amœbic dysentery, intestinal coccidiosis, relapsing fever, typhus fever, night vision and dark adaptation, bone fractures, insect attractants.

ROSEN, GEORGE, ENLOE, C. F., AND SAFFER. *Der Kaiser Wilhelm Institut für medizinische Forschung*, Heidelberg-Medical. Off. Pub. Bd., Report, PB 232. 1945. 16 pp. Price: Mimeo., 10c.

Report on nature, properties and therapeutic value of the following substances investigated by Professor Richard Kuhn at the institute: (1) 2_1 2′ dioxybenzi of salicil: a substance developed for the treatment of all types of coccal infection and diseases of the kind in which at present penicillin is indicated. (2) Alpha-tocopherol: added to the diet of animals fed on highly purified protein, it prevented deleterious alteration in the fat metabolism of the liver. (3) Cyclodekapentæne, a cyclic hydrocarbon found to be an extremely active agent against Gram-negative bacilli. (4) Vitamin B_6 (5) Tetrazolium, an agent which will provide a precise, quantitative fertility index for any given lot of seed, synthesized from benzaldehyde, phenylhydrazine and aniline.

SCHNABEL, G. P., AND HAAVIK, JOHN E. Report on malarial research resulting from interrogation of Professor Claus Schilling. Off. Pub. Bd., Report, PB 23. 1945. 4 pp. Price: Mimeo., 10c.

Brief discussion of the experimentation carried on at the Dachau concentration camp, using the inmates as subjects in order to find a method of building up immunity to malaria. This was done by injecting the patient with malaria, and after seven to nine days administering quinine, "Atebrin", "Neosalvarsan", or a combination of these drugs. This procedure was repeated several times. Reasonable success was obtained.

SMITH, SIDNEY. Dr. Habs, German malariologist. Off. Pub. Bd., Report, PB 538. 1945. 22 pp. Price: Photostat, $2.00; Microfilm, 50c.

This report deals with interviews with a number of German doctors interested in malaria and tropical diseases. A fluorimetric method of estimating "Atebrin" in the blood accurate to $\pm$ 50γ is mentioned, details of which were taken by a Dr. Rice, an American co-investigator. A nephelometric method for estimation of "Santochin" is also mentioned.

SMYTH, G. E. Oberfeldarzt Professor Hugo Spatz, the Department of Brain Research, Kaiser Wilhelm Institute. Off. Pub. Bd., Report, PB 537. 1945. 11 pp. Price: Photostat, $1.00; Microfilm, 50c.

This report contains brief notes on the organization for the treatment of neurosurgical and neurological cases in the German Army and Air Force and information in the methods used in treatment of various types of head injuries. It was generally felt that the work of this Kaiser Wilhelm Institute was based on old-fashioned morbid anatomy and will probably be sterile. Also included is a general review of neurosurgical practice in Germany based on interviews with General Arzt and Professor Tonnis. This covers the primary neurosurgical operations, the treatment of infection in brain wounds, surgical technique, repair to bone defects, and results. The investigators concluded that German neurosurgical technique is crude and that ignorance of the uses of penicillin is responsible for the high incidence of infection and high mortality.

SOUTHWORTH, HAMILTON. Clinical testing of antimalarials by I. G. Farben, Elberfeld, Germany. Off. Pub. Bd., Report, PB 238. 1945. 13 pp. Price: Mimeo., 25c.

This is a literal translation of a report prepared by Dr. Schonhofer and Dr. Kikuth of I. G. Farben, Elberfeld. According to Dr. Schonhofer the report covers all the antimalarials, except "Atebrin", "Dimeplasmin" and "Diapromin", manufactured by I. G. Farben since 1924, that have been subjected to clinical tests. Structural formulæ are given.

WILLIAMS, DENNIS. Neuropsychiatric organizations in the German Air Force. Off. Pub. Bd., Report, PB 391. 1945. 17 pp. Price: Photostat, $2.00; Microfilm, 50c.

Conclusion: "All information obtained upon Luftwaffe neurology, neurosurgery and psychiatry was of historical interest only. Nothing new or of practical value was seen. The Germans in this field seem to have . . . made little attempt at investigation and critical planning. In physical matters they were hampered by bad technique, utter complacency and almost complete ignorance of the literature in English. . . . In psychiatry a rational application of accepted principles was made possible by the official policy of refusing

[1] Supplied by the Information Service of the Council for Scientific and Industrial Research.

to admit the existence of neurosis, or its precursors in the Herrenvolk. Psychology ceased to play any part in the Luftwaffe after 1942 for the same reason." Mention is made of a full report of the psychological tests used and results obtained, being compiled by Dr. Gerathewohl. Supplementary comments are contained in this report.

WINFIELD, R. H. Preliminary report of points of interest in aviation medicine and physiology in Belgium and France. Off. Pub. Bd., Report, PB 158. 1945. 11 pp. Price: Mimeo., 25c.

This report gives a brief account of matters of interest in aviation medicine and physiology observed during a brief visit to Belgium and France. It discusses German oxygen production, liquid air factories, pressure cabins, and the subject of decompression.

ZOLLINGER, ROBERT M., *et alii*. Medical, dental and veterinary education and practice in Germany as reflected by the Universities of Leipzig, Jena, Halle and Erlangen. Off. Pub. Bd., Report, PB 357. 1945. 55 pp. Price: Mimeo., 50c.

(1) Medical practice and education in Germany (enrolment, curriculum, graduate work, research). (2) Dental education. (3) Prevention of dental caries. (4) Veterinary education and research. (5) Chemical food analysis. The report includes enrolment statistics, 1939-1945, and bibliographies of the writings of the scientists interviewed.

ANDREWS, A. H. Acceleration tolerances of the human body. Off. Pub. Bd., Report, PB 896. 1945. 4 pp. Price: Photostat, $1.00; Microfilm, 50c.

Research done by the *Medizinisches Forschungs-Institut, Garmisch-Partenkirchen*, under the direction of Dr. Ulrich Henschke, mainly with respect to aircraft crashes and design as related to protection of personnel. The results are summarized as follows. An accelerative force of 10 G. during ·01 second against the head causes symptoms of cerebral concussion. An accelerative force of 34·3 G. with the body supported by the chest and abdomen in a fashion analogous to seat belt and shoulder harness support is the maximum tolerated without symptoms of cerebral concussion. The limit of accelerative forces tolerable by the body is limited by the degree of force transmitted to the head which cannot exceed 10 G. It would seem that cockpit, seat, seat belt and harness should be designed to withstand, during crashes, at least 34 G.

ANSLOW, WILLIAM P., JUNIOR, HOUCK, C. RILEY, AND SMITH, HOMER W. Summary report on "the systemic pharmacology and pathology of the sulphur and nitrogen mustard", to October 1, 1945. (OSRD Report 6325.) Off. Pub. Bd., Report, PB 5948. 1945. 151 pp. Price: Microfilm, $2.00; Photostat, $11.00.

This report, prepared under contract with the New York University, is the draft of one of the chapters for the OSRD Division 9 Summary Technical Report. It is a review of classified literature concerning the β-chloroethyl vesicants. Attention is chiefly given to bis (β-chloroethyl) sulphide (H), ethyl-bis (β-chloroethyl) amine (HN_1), methyl-bis (β-chloroethyl) amine (HN_2), tris (β-chloroethyl) amine (HN_3) and isopropyl-bis (β-chloroethyl) amine (TL 301). Data are included on additional compounds deemed pertinent to the understanding of the above compounds. Tables are included.

BERGMANN, MAX, *et alii*. The penetration of vesicant vapours into human skin (Supplement OSRD Report 4855) to May 15, 1945. Off. Pub. Bd., Report, PB 5881. 1945. 7 pp. Price: Microfilm, 50c.; Photostat, $1.00.

A procedure has been devised for the study of the rates of penetration of vesicant vapours into human skin under conditions where the skin is exposed to graded vapour concentrations of a vesicant. This method is based on the finding that solutions of H (or ethyl-H) in dibutylphthalate (mol fraction 0·10-1·00) obey Raoult's law. Two tables are given. This is a progress report under contract with the Rockefeller Institute for Medical Research.

BRYSON, VERNON, *et alii*. Fifth monthly report on Supplemental Agreement No. 4 to Contract No. W-266-CWS-246 between the War Department and the Long Island Biological Association, Inc. Off. Pub. Bd., Report, PB 6298. 1946. 5 pp. Price: Microfilm, 50c.; Photostat, $1.00.

Progress report. The fourth monthly report showed that on occasion more than 50% of the bacteria recovered on open plates prior to treating the air with hypochlorite are still viable under conditions of the experiment. Consequently, hydrogen peroxide has been substituted to determine if it might be a more effective germicide when used as an aerosol for the disinfection of closed atmospheres. Report includes colorimetric determination of hydrogen peroxide recovered from the air, production and sampling of hydrogen peroxide aerosols, discussion, conclusions, and a table.

CANNAN, R. KEITH, AND SMITH, HOMER W. Special report on "the inactivation of enzymes by mustard gas" to March 1, 1943. (OSRD Report 1248.) Off. Pub. Bd., Report, PB 5903. 1943. 30 pp. Price: Microfilm, 50c.; Photostat, $2.00.

This summary and bibliography is a report under contract with New York University. It is probable that enzymes do differ characteristically in the rates at which they are inactivated by mustard under standard conditions *in vitro*. Only a few enzymes have competition factors great enough to warrant the belief that they compete effectively with the large quantity of protein which is available in the cell for mustard reaction. Even in the case of inactivation of sensitive enzymes by mustard, it is not demonstrated that the in-vitro inactivation results from reaction with active groups, rather than from non-specific reaction of the enzyme as protein. In no case has it been possible as yet to reverse the inactivation of an enzyme, or to recover proteins in their native state, by means compatible with cell life. The belief that vesication issues from enzyme inactivation is rendered more uncertain by the fact that skin metabolism is reduced, and most enzymes are appreciably inactivated *in vivo* only after the first half-hour, the interval in which apparently irreversible action to the skin has been effected. Tables and a graph are included.

COHEN, BARNETT, *et alii*. Final report under Contract OEMsr-532. (OSRD Report 5146.) Off. Pub. Bd., Report, PB 5864. 1945. 22 pp. Price: Microfilm, 50c.; Photostat, $2.00.

Studies were made, mainly in dilute aqueous solution, on the rates of reaction and other physico-chemical properties bearing on the toxic action of the following: (*a*) nitrogen mustards, (*b*) quaternary *N*-β-chloroethylammonium compounds, (*c*) bis-(β-chloroethyl) sulphide and benzyl-β-chloroethyl sulphide, (*d*) di-isopropyl fluorophosphate, (*e*) sodium fluoroacetate, and (*f*) di-sulphur decafluoride (S_2F_{10}). Tables are given. This is a final report under contract with the Johns Hopkins University and covers studies from September, 1941, to February 28, 1945.

CORI, CARL F., *et alii*. Effects of bis (β-chloroethyl) sulphide (H) and bis (β-chloroethyl) methylamine (HN_2) on enzymes *in vitro* and *in vivo*, to February 28, 1945. (OSRD Report 5245.) Off. Pub. Bd., Report, PB 5874. 1945. 41 pp. Price: Microfilm, 50c.; Photostat, $3.00.

The effects of H and HN_2 on enzymes *in vitro* and *in vivo* are tabulated and discussed from the standpoint of the enzyme theory of vesicant action. A generalized summary of the inactivations of enzymes by HN_2 and H is given. The effects of H parallel those of HN_2, with the latter being somewhat more effective as an enzyme inactivator in isolated tissues or after injection into animals. The data as a whole show that one cannot predict, on the basis of the effects of vesicants on enzymes in solution, whether or not a given enzyme will be inactivated by the vesicants *in vivo*. Furthermore, when the in-vivo effect of a vesicant on the enzyme of a given tissue has been established, this knowledge cannot be applied a priori to other tissues. This is a formal progress report on work done at the Department of Pharmacology, Washington University School of Medicine, St. Louis, Missouri.

CORI, CARL F., *et alii*. Effects of methyl fluoroacetate on isolated tissues and enzyme systems, to March 20, 1945. (OSRD Report 4984.) Off. Pub. Bd., Report, PB 5873. 1945. 32 pp. Price: Microfilm, 50c.; Photostat, $3.00.

This report includes an analysis of the effect of methyl fluoroacetate on the oxidative metabolism of muscle which may throw some light on the mechanism of cardiac failure in animals poisoned with methyl fluoroacetate. Experiments are included which show that the hydrolysis of methyl fluoracetate by tissues is rapid enough to expect part of the toxic action to be exerted by the fluoroacetate ion. Tables and graphs are given. This is a progress report under contract with Washington University.

DAVIS, SELBY B., ROSS, WILLIAM F., AND BALL, ERIC G. Progress report on "a study of the reaction between mustard gas and proteins", to June 7, 1943. (OSRD Report 1630.) Off. Pub. Bd., Report, PB 6806. 1943. 20 pp. Price: Microfilm, 50c.; Photostat, $2.00.

This report indicates the principal chemical changes occurring in oxyhæmoglobin and serum albumin when mustard reacts with aqueous solutions of these two proteins. The quantitative studies of the reactions of mustard with proteins have a direct bearing on the understanding of the mechanism by which mustard exerts its vesicant action and on the knowledge of the possible reversibility of the changes which it produces. Charts and tables are included.

DILL, DAVID B. Metabolic effects of low temperatures. (Army Air Force. Experimental Engineering Section EXP-M-54-653-55.) Off. Pub. Bd., Report, PB 5119. 1941. 7 pp. Price: Microfilm, 50c.; Photostat, $1.00.

Thirteen officers, soldiers and civilians in the Aero Medical Research Unit, Equipment Laboratory, were subjects of tests to evaluate the magnitude of the increased demand for oxygen due to cold. Data presented in tabular form indicate that exposure to cold may increase the oxygen requirement to six times the rest level.

British Medical Association News.

SCIENTIFIC.

A MEETING of the New South Wales Branch of the British Medical Association was held on June 27, 1946, at the Robert H. Todd Assembly Hall, British Medical Association House, 135, Macquarie Street, Sydney, DR. A. C. THOMAS, the President, in the chair.

Alcoholism.

DR. C. C. MCKELLAR read a paper entitled "Alcohol" (see page 268).

DR. S. J. MINOGUE read a paper entitled "Alcoholism" (see page 271).

PROFESSOR W. S. DAWSON said that there was hardly a subject which had caused such a stirring of the emotions as that of alcoholism. It was an old problem in New South Wales. Some extracts from *The Illustrated Sydney News* of December 23, 1869, were pertinent. The Chief Justice of the time drew attention to the 3,000 people committed for drunkenness; 40% of the admissions to Sydney hospitals were ascribed to intemperance. The Chief Justice went on to say that these evils in number, extent and consequence and the amount of suffering they inflicted were in his opinion more terrible than the ravages of war or the horrors of destruction. Professor Dawson went on to say that some years earlier a welfare organization in England had put forth the slogan: "Behind every social problem you will see the hidden hand of alcohol." *Punch* had commented: "Now you see it and now you don't." Professor Dawson said that he was not quite persuaded that Dr. Minogue had made a clear distinction between the normal and abnormal aspects of the imbibing of alcohol. Professor Dawson agreed that often the definition was hard to make, and suggested that one might refer it to the degree of control exercised by an individual. That led to another observation, that in his own opinion reform in alcoholism would come mainly, if not entirely, through the development of public opinion. He thought that there was a great deal of false and misleading sentiment on the subject of alcoholism. He was of the opinion, although he was a psychiatrist, that there was too much readiness to talk of it as if it was a disease, and that in many instances it could be looked at more as a manifestation of poor education or bad manners and indecent conduct. He thought that more instruction and a harder general attitude towards the standards of decent behaviour would go very far and be a potent force in encouraging the intemperate to be more moderate. They were, all of them, the general public included, too inclined to look on cases of drunkenness with a sort of amused tolerance, and that attitude was not very helpful. At the same time one had to recognize that alcohol did afford relief to the unstable and the morbidly anxious, and one might question whether it was better to allow them their alcohol or to fill them up with phenobarbital or some similar substance. Dr. Johnson, on the subject of happiness, had said: "Consider no man happy unless he is drunk." Professor Dawson agreed with Dr. Minogue that a great deal could be done through moral influences, but he did not share his pessimistic opinion on the efforts of the medical profession to deal with the problem; Dr. Minogue had admitted that he had met with difficulties himself. Most of those present had to deal with alcoholics either in the acute stages or suffering from the effects. Treatment consisted in cleaning them up, relieving their headaches, restoring their appetites and unwillingly discharging them from hospital to resume their drinking habits. It was always difficult to get hold of an addict before he had been on another bout. It seemed that all the methods devised to deal with alcoholism, among them moral suasion and influence and "Alcoholics Anonymous" and their moral forces, were admirably adapted to the less determined alcoholics who were willing to be led along the path of sobriety. Professor Dawson agreed with Dr. Minogue that alcoholics could be divided into two classes, those who wished to get well and those who did not. Unfortunately many were obstinately resistant. As both speakers had indicated, the subject was immensely wide, and it was possible to go on learning more and more about the medical and sociological aspects. Professor Dawson concluded by expressing appreciation of the papers.

DR. A. T. EDWARDS said that he joined issue with Dr. Minogue, as he had done previously. Dr. Minogue denied that alcoholics could receive efficient treatment in mental hospitals. Dr. Edwards did not doubt that "Alcoholics Anonymous" held out great hopes for the alcoholic who wanted to be cured. But there were many who did not want to be cured, who were wasting their financial substance, who were a source of worry, probably cruelty, to their wives and families, and who, if they were merely arrested for drunkenness, on their release took up again their old habits. For them there could be only one solution—enforced and prolonged detention where they could have no access to alcohol. Unfortunately, after two or three months in a mental hospital, they were given perhaps a day's leave; they went out and met their friends and returned to the hospital invariably full of alcohol. Dr. Edwards said that he had been for four years in charge of the mental hospital at Morisset; most alcoholics were sent there against their will. If they were not kept for the full twelve months, it was merely waste of time taking them there at all. There were two very necessary points in their treatment. (i) They must have a year's enforced detention. (ii) They must be treated by a medical officer who himself believed in total abstinence for them. Dr. Edwards said that he himself was a "wowser", and he found the fact very useful. He could point out to his alcoholic patients that alcohol was not necessary for a normal life. He found also that as he was not one of the rabid temperance advocates, his patients were prepared to accept him as someone to whom they would listen. For instance, they appreciated his experience in poker schools, for when once the bottle began to circulate he knew that he was in for a very satisfactory night's winnings. This was a different approach from what his patients had had; the earlier approach had been on religious lines and not on a friendly basis. Dr. Edwards had not experienced the hostility towards the medical profession that Dr. Minogue had mentioned. The results at Morriset were satisfactory. There had been many failures, but some of the patients had remained total abstainers. Even now he met men whom he had treated at Morisset and who had remained abstainers for as long as fifteen years. However, before any form of treatment could be called efficient, the patients had to be examined again after five years. Many after five years thought that one or two drinks would do them no harm; they took these drinks and relapsed. In the treatment of alcoholics it was most necessary to turn them into total abstainers. Dr. Edwards also joined issue with Dr. Minogue on the method of treatment. He said that treatment was just as good with glucose, chloral, paraldehyde and hyoscine as with brandy. If the medical attendant gave them brandy he at once indicated to them that there was some necessity for alcohol and it became difficult to persuade them that at no time was alcohol necessary for their mental and physical well-being.

DR. S. G. NELSON said that two aspects of the problem had been put before the meeting, one the social aspect, with an array of figures concerning the cost to the nation and the income derived by the treasury, the other plainly an exposition of the clinical manifestations of severe alcohol addiction. Those present were taught in all medical problems to regard early diagnosis as paramount. While one could think of the cost to the poor of alcoholism and the diversion of a high percentage of their income to an unnecessary foodstuff or drug (according to the point of view), and the influence of alcohol on the moral fibre and the state of health of the addict, medically it was necessary to have some distinction between the man who could take a little alcohol and then stop and the man who with his first glass started on the pathway of progressive addiction. Dr. Nelson asked whether it was possible to make this distinction at an early enough stage to effect a cure before it was necessary to put people in institutions for breaches of the various acts on the statute books and treat them at a comparatively late stage.

DR. L. E. HEWITT said that alcoholism was a reaction against a bleak environment and the cure lay in the alteration of the environment. He could not see any immediate possibility of cure. The world could not alter the environment quickly. But there was one very potent weapon; Dr. Hewitt pleaded for the use of ridicule. He said that he would like to see this weapon used in the treatment of intemperance. It had been used in one part of the world. Any person, usually a young person starting on the thorny path for the first time, was immediately exposed to the ridicule of his fellows. The whole incident was filmed, and next morning the culprit was shown the whole thing on the screen. The results had been satisfactory.

Dr. McKellar, in reply, once more urged the treatment of alcoholics in mental institutions provided adequate facilities were available. Medical staffs could visit them and arrangements could be made for the treatment of their injuries. While a man was drunk he was a mental patient. Dr.

Minogue disagreed with this proposition; yet he said that the best treatment was given by those experienced in the subject, with an experienced staff; he must mean the staff in a mental hospital. Dr. Minogue must have forgotten the other people in general hospitals who were obliged to witness the unpleasantness attendant on the admission and treatment of an alcoholic. Many of the other patients were women and children, and the dirty alcoholic was frequently treated in their sight or hearing; he was a dirty alcoholic at the time, however decent after he had recovered.

Dr. Minogue, in reply to Professor Dawson, said that as a result of his experience of many thousands of alcoholics, and especially of his experience during the last eighteen months, he agreed with the Americans that alcoholism and inebriacy were diseases. One saw a man who was perfectly normal and had one drink; his whole personality changed immediately and he had no more control. Experimental work on mice had been carried out in America. If the mice were given alcohol, and then some form of glandular treatment was carried out, they no longer wanted alcoholic drinks. Men and women who became addicts were dominated by an irresistible impulse; therefore addiction to alcohol was a disease. Dr. Minogue then referred to the differentiation between an alcoholic and an inebriate. He said that in the last eighteen months he had tried to find it and still could not make the distinction with accuracy in a number of cases. Many men drank because they wanted to drink; but they could give up the habit if they were persuaded to do so. The inebriate could not stop after one drink. The alcoholic next morning had a severe headache, but was able to carry on with his ordinary work. The inebriate on the next morning was so shaky and tremulous that he could not do without more alcohol to keep him steady. Dr. Minogue said that the two men were entirely different, and what the difference was he had not the faintest idea. Dr. Edwards had referred to the good results obtained by the treatment of alcoholics in mental hospitals. Dr. Minogue said that during the last eighteen months the worst subjects with whom he had come in contact were those who had been treated in mental hospitals by Dr. Edwards, Dr. McGeorge *et cetera*. Their very episodes in mental hospitals seemed to have some deleterious effect on them, but what the effect was Dr. Minogue did not know. Dr. McKellar had referred to the poor women and children in public hospitals to which alcoholics were taken; Dr. Minogue wondered in the first place what the women and children were doing in those parts of public hospitals. But if Dr. McKellar feared their contamination from contact with these alcoholic patients, what about the poor innocent psychotics and mental defectives in mental hospitals, who through no fault of their own had to associate with inebriates? Was this fair to them? However one looked at it, the alcoholic patients who had been through the mental hospitals were the worst to deal with. Dr. Edwards had said that alcoholics were best treated by doctors who were total abstainers. Dr. Minogue said that a doctor who was a total abstainer was a *rara avis*, and the choice of doctors would be too limited. Moreover, against such a doctor the inebriate would argue: "What do you know about what goes on in the mind of an inebriate? How many cures have you made?" Dr. Minogue admitted that a considerable controversy was taking place at the present time, and one's outlook largely depended on one's own attitude. If one was a total abstainer, one treated alcoholics without alcohol; if one liked alcohol in moderation, one gave them alcohol in their treatment. The personal point of view had too much importance. At the present time the treatment of alcoholism on scientific lines was almost unknown in Australia. It was possible to get alcoholics better in two or three days with huge doses of insulin; but special hospital facilities were needed, and these were practically non-existent. Dr. Nelson had asked whether the diagnosis of inebriacy could be made early enough for the patient to be treated in the initial stages. The Americans throughout their extensive literature on the subject contended that it was possible to diagnose incipient inebriacy from the first treatment. The man who had a few drinks at a party and could stop when the others stopped was a normal drinker. But if a man had to keep on drinking practically all night, he was a pathological drinker and should not touch alcohol. If one had to have a drink in the morning, one was an abnormal drinker and should not touch alcohol. If one had to have a drink in order to gain the courage to face any social or business situation, one was an abnormal drinker and should not touch alcohol. The whole treatment of alcoholism in Australia was hopeless. Neither the general hospitals nor the mental hospitals wanted alcoholics. It was essential to have special hospitals dealing with alcoholics alone and taking no other patients. Dr. Minogue hoped that in about twelve months' time this arrangement would be made and they would have gone some distance along the road to solution of the problem.

Dr. Thomas, from the chair, said that those present had all listened with interest to both speakers. Dr. McKellar had mentioned the sociological aspect of the question, and had made out a case in favour of the Queensland Branch's efforts in the matter. Dr. Thomas thought that the New South Wales Branch should do something along the same lines. When travelling in Europe he had been struck with the differences between drinking as a pastime there and in Australia and even in Britain. The light wines and spirits used did not seem to do anyone any harm and they were almost universally adopted. Dr. Thomas said that Dr. Minogue's paper had rather made him feel that his conscience was comparatively clear. In the course of some years of practice one could not help meeting the inebriate. Dr. Thomas said that his mind went back to certain people in his practice, and he wondered whether he had done the right thing for them. When a man of the experience of Dr. Minogue was convinced that he had not cured many alcoholics, then those less able to do the work might be satisfied that they had done their best. Alcoholism presented sad problems; homes were disrupted, careers and even lives were shortened. Dr. Thomas remembered two men, one a dentist who had apparently been saved from death for the time being, but for how long was not known. The other man was a source of worry and anxiety to his wife and children; in his lucid moments he was a fine fellow, but he said that he could not help his alcoholism. In conclusion, Dr. Thomas said that all those present had enjoyed the evening and learnt much from the speakers.

NOTICE.

THE General Secretary of the Federal Council of the British Medical Association in Australia has announced that the following medical practitioners have been released from full-time duty with His Majesty's Forces and have resumed, or will resume, civil practice as from the dates mentioned:

Dr. D. F. Lawson, 12, Collins Street, Melbourne (September 1, 1946).
Dr. H. W. R. Sharp, 235, Macquarie Street, Sydney (July 1, 1946).

A meeting of the Section of Neurology, Psychiatry and Neurosurgery of the New South Wales Branch of the British Medical Association will be held at 2.30 p.m. on Thursday, September 5, 1946, at the Mental Hospital, Rydalmere. The meeting will take the form of a clinical afternoon, and will be arranged by officers of the Division of Mental Hygiene, Department of Public Health of New South Wales.

Naval, Military and Air Force.

APPOINTMENTS.

THE undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, Numbers 140 and 145, of August 1 and 8, 1946.

CITIZEN NAVAL FORCES OF THE COMMONWEALTH.

Royal Australian Naval Reserve.

Transfer to Retired List.—Surgeon Commander Leonard John Dunstone is transferred to the Retired List, dated 1st July, 1946.

Resignation.—The resignation of Athol Blaubaum of his appointment as Honorary Surgeon Commander is accepted, dated 31st March, 1946.

Royal Australian Naval Volunteer Reserve.

Termination of Appointment.—Acting Surgeon Lieutenant-Commander Stanley Earles Craig, 30th May, 1946.

Naval Auxiliary Patrol.

Termination of Appointment.—The appointment of the following is terminated: Surgeon Skipper (Lieutenant) Keith Lindsay Hugh Kirkland.

ROYAL AUSTRALIAN AIR FORCE.

Citizen Air Force: Medical Branch.

The appointments of the following officers are terminated on demobilization with effect from the dates indicated: Temporary Squadron Leader W. H. Fraser (261656), 4th June, 1946, (Temporary Flight Lieutenants) K. Johns (265175), 5th June, 1946, W. R. Dalton (265172), T. H. Gaven (277462), K. T. Helms (267385), N. J. Royle (264369), 6th June, 1946.

Flight Lieutenant G. A. Levinson, M.B., B.S. (297422) is transferred from the Reserve to the Active Force for full-time duties with effect from the 11th June, 1944.

Post-Graduate Work.

COURSE IN OBSTETRICS AND GYNÆCOLOGY AT SYDNEY.

THE Post-Graduate Committee in Medicine in the University of Sydney wishes to announce that a special course in obstetrics and gynæcology will be held for two weeks beginning September 9, 1946, at the King George V Memorial Hospital, Camperdown. The fee for enrolment in this course is £5 5s., and intending candidates are requested to make early application, as enrolments are limited to sixteen. Applications should be addressed to the Secretary of the Post-Graduate Committee in Medicine, 131, Macquarie Street, Sydney.

Special Correspondence.

CANADA LETTER.

FROM OUR SPECIAL CORRESPONDENT.

THE annual meeting of the Canadian Medical Association was held at the Rocky Mountain town of Banff in June with a record attendance. One of the most striking exhibits was that of the Federal Government's Department of Veterans' Affairs, in which every phase of the surgical reconstruction and social rehabilitation programme was portrayed. The problem of the paraplegic is being given much-needed public notice in Canada, and it is hoped that the centres developed for patients from the services may soon be made available to civilian patients requiring physiotherapy and retraining.

Another type of retraining, of interest to doctors here, is the Dieppe Home for Epileptic Children, soon to be opened on a large farm in the beautiful Richelieu Valley at St. Hilaire, Quebec. Built by private subscription as a memorial to the Canadians who fell at Dieppe, this eighty-bed institution will concern itself with the retraining of young epileptics who have exceeded the compulsory school age and need training in a trade free of dangers such as those associated with machinery, loading platforms *et cetera*. Handwork is stressed. It is hoped that a fairly rapid turnover will be possible, since there are approximately 18,000 epileptics in Quebec.

The past week has seen the publication, as a public document, of a report on a survey of medical education made by Professor C. E. Dolman, of the University of British Columbia, covering the 11 schools in Canada and 22 of the leading American schools. The report was written for the guidance of the governors of the University of British Columbia at Vancouver, who are now concerned with the establishment of Canada's twelfth medical school, probably to be its last new school. No more incisive report has yet emerged from the troubled scene of post-war medical education on this continent, and it promises to be very widely read and warmly discussed.

The applications for entrance into medical schools in Canada continue to exceed by far the available places, at some schools by fifteen to one. The reestablishment benefits for veterans have made it possible for many who would otherwise have been unable to afford a medical education to pursue this study on a basis of merit. Throughout the country the results of the term-end examinations have shown that the veterans in all faculties stand, as a group, above the general average. The grants allow a single man $60.00 per month or a married man $80.00 per month, with a sliding scale for dependants beginning at $12 per month each. Tuition fees and books are paid for by the Government also. Post-graduate training in medicine is being similarly financed.

The prairie Province of Manitoba has just passed unanimously a preventive medicine act to provide full-time public health units throughout the Province. Some are already in operation. The development of public diagnostic services and preventive aids around these centres is seen as a future possibility of great significance. Saskatchewan continues to expand its programme of public medicine, and has attracted 150 new doctors to the Province within the past eighteen months. In an area chronically short of medical care, this speaks well for the type of supervision which the Provincial Government is giving to the contracts being signed by municipal doctors. They have laid down a minimum set of conditions concerning salary, leave, post-graduate training at full pay and pensions, which had greatly changed the competitive bidding down of doctors by drought-stricken areas. A new development in their ambulance service is the dropping of sera and drugs to stricken areas otherwise inaccessible. A full-time chairman of the commission developing a system of public medicine in the Province has just been appointed in the person of Dr. Fred Mott, former gold medallist at McGill University, and for the past ten years medical adviser to the Farm Security Administration at Washington.

Correspondence.

MALARIA IN THE SOUTH-WEST PACIFIC: ADDITIONAL FACTS ABOUT MALARIA CONTROL IN THE AUSTRALIAN MILITARY FORCES.

SIR: The word "additional" is included in the above title, as it is presumed that the reader has studied Brigadier N. Hamilton Fairley's article in which he makes it quite clear that with the help of "Atebrin" malaria was controlled sufficiently to allow the Australian campaigns to be successfully carried on. It is fitting that before drawing attention to some significant facts, some of which are not mentioned in Brigadier Fairley's paper, I should pay tribute to those who carried out the experiments at Cairns and to those (Brigadier Fairley in particular) who sheeted home to commanders that malaria control was their responsibility and not that of their medical officers, a change that made the life of a unit medical officer much easier.

Since my return to Australia I have met many people who have no conception of the detailed precautions actually taken by the troops themselves and the constant attention that was given to them by those in command, staff and administrative officers, combatant and medical officers and non-commissioned officers. Some precautions used in the 6th Australian Division area are as follows:

(*a*) Mosquito nets were lowered before sunset and tents sprayed out. I have seen infantrymen building frames to hold their nets and two-man tents one hour after capturing a position and under enemy mortar fire. (Incidentally, spraying with malariol was being done at the same time.)

(*b*) A repellent parade was held after mess, and all ranks applied repellent after roll call under officer supervision.

(*c*) A malaria picket made a tour of the camp at night, spraying tents and seeing that bare arms or "other large bare surfaces" were not in contact with the nets. Of course, this could not be done when in contact with the enemy, as no movement was allowed at night within a perimeter. In perimeters only the sentries were without their nets, and they applied repellent more often. It is to be clearly understood that these remarks are based on an accurate knowledge of precautions taken as well as those ordered. Lapses in personal precautions were noted by myself and Lieutenant-Colonel Jaboor (commanding officer, 2/2 Australian Field Regiment) in the Wewak-Aitape area and in Lae, Bougainville and New Britain, where we were sent by the general officer commanding the 6th Australian Division to ascertain if there were any precautions being taken in other areas which the 6th Australian Division were omitting. This we failed to do, and reported no significant difference in anti-malarial discipline.

(*d*) "Atebrin" parades. The management of administration of "Atebrin" within my own unit was as follows. After breakfast there was held an "Atebrin" parade. The only members not actually on the parade were myself (I have

never had an attack of malaria), the orderly room sergeant, pay sergeant, one orderly in each ward and detach-personnel. The last mentioned included stretcher-bearers, drivers *et cetera*, and were provided with slips which they had to return to the orderly room with the signature of an officer indicating that they had taken their "Atebrin" each day in his presence. These slips were checked against nominal rolls at the orderly room. Key personnel mentioned above went on parade immediately, took their "Atebrin" before an officer and returned to their posts. The main body then proceeded to the officer and took the "Atebrin" as their name was called as they passed him. The drinking vessel was upturned and excess water thrown on the ground. For a considerable period the "Atebrin" was actually thrown into the men's mouths by the officer. In spite of these precautions my unit had five cases of malaria in two days.

It was exceedingly difficult for a man to avoid taking the official dosage of "Atebrin", though no doubt a few possibly feeble-minded persons did so, as is well shown in the three cases quoted by Brigadier Fairley (Graph IX). On the other hand, Brigadier Fairley's graph of 477 cases (Graph X) shows that in the Aitape-Wewak area the graph of plasma "Atebrin" levels corresponded to that of the Cairns volunteers very closely.

Brigadier Fairley's Table XIII wisely shows officers and other ranks separately. It is quite a fact and possibly an indication of bad discipline that many officers in the 6th Australian Division were taking more than one "Atebrin" tablet per day, as they had been threatened with courts martial and disgrace should they contract malaria. This table is valuable therefore, provided one does not assume that officers took only one "Atebrin" tablet per day. One officer (evacuated through medical channels!) was taking twelve tablets a day.

Officers had easier access to "Atebrin" supplies, as they (especially platoon commanders) frequently carried a small reserve in case their men should lose or damage their emergency supply when on patrol *et cetera*. In the Bougainville and New Britain areas Lieutenant-Colonel Jaboor and I found that the dosage of "Atebrin" was in many cases more than one tablet a day. This fact apparently was not generally known. In one place the Deputy Assistant Director of Hygiene informed us that he had been making inquiries along these lines since our visit, and was amazed to find that a certain battalion had been placed on two a day while they were on a strenuous four-day march. Prior to this, this battalion had been used as an example to show that another battalion doing the same march (on one a day allegedly) was undisciplined, as they shortly after had several cases of malaria.

A senior medical administrative officer told us he had authorized the use of "medical" "Atebrin", that is, that supply normally reserved for treatment, to place a unit on a dosage of two a day for a week when their malaria graph gave a kick up. A brigade commander told us that he had authorized units to be put on two tablets a day for a few days when malaria incidence seemed to be rising. A battalion commander said that he had authorized his men to "lose" their emergency supply when they were involved in an outflanking movement so that that much extra "Atebrin" would be available to his quartermaster, thus enabling him to put his unit on two a day for a while when malaria was on the rise in his unit. Two medical officers volunteered the statement that the men preferred "Atebrin" to aspirin at the regimental aid post for headaches. It was a recognized practice to put men on two a day for a day or so before and during patrols. By these means the troops in Bougainville and New Britain achieved their excellent and unprecedented results in malaria control as is clearly shown in Brigadier Fairley's Graph III. If our observations are accepted, it will be seen that care is necessary in interpreting this graph in regard to making comparisons between the incidence in one area and another since the "Atebrin" dosage varied so much.

Although all the areas were highly malarious as judged by spleen rates and adult anopheline population, the question of DDT sprays must be considered when comparing one area with another. In the Wewak area, where I have killed seventeen anophelines under the mess table while losing at poker, it was never possible to arrange a DDT spray before or soon after troops entered any area recently occupied by natives or the enemy. In some other areas this was done on the day of entry or even before Australian troops arrived and a large number of this infected generation of anophelines killed off.

Thus it will be seen that in the graph showing incidence in the various areas there were severable variables and discipline may not have been one at all.

Morale has been quoted as a possible explanation for high malaria incidence in certain areas. It is difficult to write facts about morale. Lieutenant-Colonel Jaboor and I concluded that from the first-hand knowledge we had of the Australian Imperial Force in battle and our observations and reports of the militia in Bougainville, there was no difference in morale that could have influenced the malaria graph. It is hard to imagine that there should be such a variation in groups of Australian soldiers occupied in similar operations under similar climatic conditions and with similar success over the enemy.

Yours, etc.,

11, Locksley Street, Killara, New South Wales.
August 6, 1946.

CLIVE H. SELBY, M.B., B.S.

REHABILITATION OF WAR NEUROTICS.

SIR: In reply to Dr. Lipscomb, my comments respecting the examination of recruits were obviously confined to psychiatric examination. In the first four years of the war I examined many hundreds of recruits both at Victoria Barracks and Bondi Area and observed the examinations carried out by some thirty to forty medical practitioners. The attempt at psychiatric examination was almost nil, and in the *questionnaire* to be filled in only one question in any way related to the mental make-up of the recruit and less than six lines in the book of instructions to medical officers were devoted to psychological requirements.

The average time for examination was less than five minutes, and no doctor could possibly sum up the psychology of a recruit in this period. As far as I know there are no criteria by which the suitability of personnel could be judged. Surely the experience of the 1914-1918 war, with the numerous cases of "D.A.H." and other war neuroses, could have been utilized in several lectures and/or brochures to medical officers examining recruits for this recent war.

The numerous tragedies we see every day in broken homes, marriages, careers *et cetera* are a witness to this lack of psychiatric treatment. Firstly as prophylaxis in refusing unsuitable recruits; secondly in vocational selection (picking the right job for the right man); and lastly, rehabilitation in civilian life.

I have been practising medicine for over seventeen years; was resident medical officer for two months to the repatriation wards at the Perth Public Hospital and repatriation medical officer in the country for five years. The abnormal psychology of many of the returned soldiers was very distressing.

I yield to no man in my respect for the senior general practitioner, and the high place that I have accorded to him in the training of future practitioners bears eloquent testimony to this. If Dr. Lipscomb had read my articles on "Fatigue" and "The Adequacy of Medical Training", I am certain he would appreciate this.

The only hope that I can see in minimizing the vast amount of abnormal psychology in discharged personnel, both male and female, is to have a special course arranged by psychiatrists to be given to all practitioners giving the correct perspective of the problem and relevant guidance in its treatment. With the cooperation of the general practitioners throughout Australia the gain in national morale and better citizenship would be very great and the economic saving considerable.

Yours, etc.,

270, Bondi Road, Bondi, New South Wales.
August 9, 1946.

BASIL WILLIAMS.

ALCOHOLISM.

SIR: On further consideration of the papers and discussions on alcoholism it occurs to me that not enough emphasis was placed on the fact that the morbid effects are seen for the most part in individuals aged between thirty and fifty or so, who have been steady and heavy drinkers since their late teens. Here the psychiatrist, as in so much of his work, has to try and transform the injurious habits of some ten, twenty or more years.

It was this point that I had in mind when I referred to the importance of education of the young in decent standards of conduct. Drunkenness should more often be regarded as indecent behaviour rather than as a manifestation of a "disease".

The reduction of the alcoholic content of liquors as stressed by Dr. McKellar and the provision of facilities for drinking in more æsthetic surroundings than the present pig-sty conditions are some of the influences which might conduce to a higher standard of sobriety and decency of behaviour in the community.

Yours, etc.,

W. S. DAWSON.

Sydney,
June 28, 1946.

Obituary.

WESLEY RAINSFORD GROVES.

WE are indebted to Dr. J. Horace Downing for the following tribute to the late Dr. Wesley Rainsford Groves.

Wesley Rainsford Groves has left us, but has left such a memory that those who take pleasure in the beautiful things will pause and find that noblest of treasures—a gentleman. Enthusiastic to the last, he spent this afternoon in seeing a couple of patients, in doing a few holes of golf, in pruning some roses, then in the comfort of his home he slipped away without pain or distress.

Born at St. Kilda on September 2, 1879, he was educated at Brighton Grammar School and the University of Melbourne. He passed through Kyneton when a second year student and remarked to a companion: "What a God-forsaken hole this would be to live in." Yet here in Kyneton he practised for forty-four years and gained and left all that a man might desire. His interest in his work was intense and never failed; his golf was his recreation, his garden was his hobby, and his home was his haven.

Various communications to THE MEDICAL JOURNAL OF AUSTRALIA came from his brain. He was intensely keen on correlating post-mortem findings with ante-mortem conditions. It may be too much to claim for him the treatment of general peritonitis, present or threatened, with morphine and saline solution. Certainly I learned that method from him and he contributed an article to THE MEDICAL JOURNAL OF AUSTRALIA—the first I read on the subject. His method of inversion of the stump of an appendix was the result of a hint from a North American medical journal, and illustrates his anxiety for improved technique. In twenty years I did not see it fail, and it is mentioned to indicate the flexibility of a mind which remained clear till the last minute.

With his patients he was the kindly friend; and the State which prejudices the development of the general practitioner of his type will have lost one of the best of God's gifts to stricken humanity.

Sweetpeas were his specialty, and I am afraid I have been guilty of smiling to myself when I saw the tenderness with which he nipped off the errant shoots from a six-foot stalk that the prized blooms at the top be not diminished. Aphides were best dealt with by finger and thumb.

His home life was happy, and as the grandchildren came his cup of joy overflowed.

Groves died at sixty-six. At the age of sixty-two he told me that he had reached the age at which his father died from angina and that he had begun to develop breast pain relieved by nitroglycerin—just giving a detached medical summary of a patient. He carried on till he became enthusiastic about the results of the stellate ganglion operation, and this was subsequently done by Mr. Hugh Trumble with the happiest results after three months. Perhaps too happy—for he did not put himself first.

So passes a friend—W. R. Groves, M.D., B.S., F.R.A.C.S.

Nominations and Elections.

THE undermentioned has applied for election as a member of the New South Wales Branch of the British Medical Association:

Symonds, Lloyd Saul, M.B., B.S., 1945 (Univ. Sydney), 37, Oliver Road, Roseville.

Medical Appointments.

Dr. C. Craig and Dr. G. M. Clemons have been appointed members of the Medical Council of Tasmania in accordance with *The Medical Act*, 1918, of Tasmania.

Dr. C. S. Kerr, Dr. H. E. W. Lyons and Dr. H. G. Andrew have been appointed honorary assistant anæsthetists at the Royal Adelaide Hospital, Adelaide.

Dr. T. Wunderlich has been appointed Government Medical Officer at Bowraville, New South Wales.

Dr. W. V. Russell has been appointed Government Medical Officer at Pambula, New South Wales.

Diary for the Month.

AUG. 27.—New South Wales Branch, B.M.A.: Ethics Committee.
AUG. 28.—Victorian Branch, B.M.A.: Council Meeting.
AUG. 29.—South Australian Branch, B.M.A.: Scientific Meeting.
AUG. 29.—New South Wales Branch, B.M.A.: Branch Meeting.
SEPT. 3.—New South Wales Branch, B.M.A.: Organization and Science Committee.
SEPT. 4.—Western Australian Branch, B.M.A.: Council Meeting.
SEPT. 4.—Victorian Branch, B.M.A.: Branch Meeting.
SEPT. 5.—South Australian Branch, B.M.A.: Council Meeting.
SEPT. 5.—New South Wales Branch, B.M.A.: Special Groups Committee.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Honorary Secretary, 135, Macquarie Street, Sydney): Australian Natives' Association; Ashfield and District United Friendly Societies' Dispensary; Balmain United Friendly Societies' Dispensary; Leichhardt and Petersham United Friendly Societies' Dispensary; Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney; North Sydney Friendly Societies' Dispensary Limited; People's Prudential Assurance Company Limited; Phœnix Mutual Provident Society.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federated Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178, North Terrace, Adelaide): All Lodge appointments in South Australia; all Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205, Saint George's Terrace, Perth): Wiluna Hospital; all Contract Practice appointments in Western Australia. All government appointments with the exception of those of the Department of Public Health.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

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Members and subscribers are requested to notify the Manager, THE MEDICAL JOURNAL OF AUSTRALIA, Seamer Street, Glebe, New South Wales, without delay, of any irregularity in the delivery of this journal. The management cannot accept any responsibility or recognize any claim arising out of non-receipt of journals unless such a notification is received within one month.

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